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JAPANESE [JP,2001-517001,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART TECHNICAL PROBLEM MEANS DRAWINGS

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the approach of adjusting the forward traffic channel power allocation in communication system. The step which measures each signal quality of the pilot wave who can set to the active set of mobile station, and who was transmitted by two or more base stations, respectively with said mobile station, A step [criteria / signal quality / said / of said pilot wave / each], The step which reports the message which shows which [of said pilot wave in said mobile station] is equal to said criteria, or whether it is over it to a system control station, How to consist of a step which adjusts said forward traffic channel power allocation based on said message.
[Claim 2] Said step to compare Step which generates a threshold as said criteria based on at least one of said the pilot waves who cover the time interval decided beforehand and have the greatest measurement-signal quality Approach containing a step [said threshold / each / of each of said signal quality of said pilot wave] according to claim 1.
[Claim 3] Said step to report Step which generates the bit vector listed in the sequence that the value showing each signal quality of said pilot wave was able to be decided beforehand The approach according to claim 2 of consisting of a step which includes the index which identifies which [of said pilot wave] has the greatest measurement-signal quality in said bit vector list.
[Claim 4] Said step to report is CDMA. It is an approach including reporting said bit vector to a system control station at least at once about all the frames of an IS-95 protocol according to claim 3.
[Claim 5] Said step to report is CDMA. Approach including reporting said bit vector to said system control station in at least one of two or more frames of an IS-95 protocol, and the parts of said frame according to claim 3.
[Claim 6] said communication system -- CDMA IS-95 communication system is included and said step to notify is periodic or aperiodic -- approach including notifying said bit vector by either according to claim 3.
[Claim 7] It includes that said step to measure measures each signal pair interference ratio about said pilot wave. Said step to generate is an approach according to claim 2 including generating a threshold based on at least one of the maximums of each of said signal pair interference ratio about said pilot wave.
[Claim 8] Said step to generate is an approach including subtracting the level decided beforehand from the maximum of each of said signal pair interference ratio, and generating a threshold signal according to claim 7.
[Claim 9] The maximum of each of said signal pair interference ratio is an approach [step / said / to compare / each / of each of said signal quality of said pilot wave / the minimum value of said maximum of said signal pair interference ratio of said pilot wave / have the minimum value and] according to claim 8.
[Claim 10] Said step to list is a step which receives the hand off instruction message identified in the sequence that said base station was able to be beforehand decided in said active set of said mobile station. Step which arranges each data field of said bit vector so that it may correspond to said sequence The approach according to claim 3 of containing further the step

which arranges each value which shows whether each of said pilot wave exceeds said threshold signal to said each data field.
[Claim 11] the one-set reception corresponding to said pilot signal in said step to receive -- direct and a multi-pass signal -- receiving -- reception -- said set of direct and a multi-pass signal the each -- reception of said N individual -- with direct and the subset of a multi-pass signal being included [of N individual which shows a larger direct and signal pair interference / than each of the signal of the subset which does not exist in the subset of a multi-pass signal / ratio] -- said step to arrange -- said each of said pilot wave -- reception of N individual of said subset, direct and only when it corresponds to at least one of the multi-pass signals The approach according to claim 10 of arranging said each value which shows each of said pilot wave exceeding said threshold signal in said each data field.
[Claim 12] The approach according to claim 10 of containing further the step which adds the active set data field which at least one of a current active set, the past active set, and future active sets can identify to said message.
[Claim 13] Said step to measure is an approach including measuring the signal quality of the pilot wave transmitted by one sector [at least one], respectively of said two or more base stations in said active set according to claim 1.
[Claim 14] Said step to adjust is which of said base station transmitting each code channel to said mobile station, and forming the forward traffic channel power allocation control command which shows which not transmitting each code channel to said mobile station. Approach including notifying said forward traffic channel power allocation control command to said two or more base stations in said active set according to claim 1.
[Claim 15] Step which starts a timing mechanism with said mobile station when said message is reported to the beginning from said mobile station The approach according to claim 1 of containing further the step which observes when the time delay corresponding to the time difference during the time of the time of said message being first reported from said mobile station and said forward traffic channel power being adjusted passed.
[Claim 16] The approach according to claim 15 of being finger allocation of the diversity receiver of said mobile station of at least one finger, and containing further the step which changes said finger allocation corresponding to said pilot wave to whom it was reported within said message at said step which is equal to said criteria or exceeds it, and to report.
[Claim 17] Said step to form is the approach according to claim 14 of forming said forward traffic channel power allocation control command which shows that said base station below N individual should transmit each code channel to said mobile station when N corresponds to the number of fingers of the diversity receiver in said mobile station.
[Claim 18] Said step to compare includes that at least one finger of a diversity receiver determines whether it is assigned to code channel signaling from the base station. Said step to report is an approach including reporting which [of said base station] supplies each code channel signaling assigned to at least one finger according to claim 1.
[Claim 19] Said step to report is an approach containing the step which generates the bit vector which lists the value showing each signal quality of said pilot wave in the sequence which was able to be decided beforehand according to claim 18.
[Claim 20] Said step to report is an approach containing the step which contains in said bit vector the index which identifies one of said two or more of the base stations which has at least two fingers assigned to it according to claim 19.
[Claim 21] Said step to report is CDMA. It is an approach including reporting said bit vector to a system control station at least at once about all the frames of an IS-95 protocol according to claim 19.
[Claim 22] Said step to report is CDMA. Approach including reporting said bit vector to said system control station about at least one of the parts of said two or more frames of an IS-95 protocol, and said frame according to claim 19.
[Claim 23] said communication system -- CDMA it consists of IS-95 communication system, and said step to notify is periodic or aperiodic -- approach including notifying said bit vector by either according to claim 19.

[Claim 24] Said step to generate The step which receives the hand off instruction message which identifies said two or more base stations in the sequence beforehand decided in said active set, The step which arranges each data field in said message about each of two or more of said base stations so that it may correspond to said sequence, The approach according to claim 18 of containing further the step which arranges each value which shows whether said at least one finger of said diversity receiver is assigned to said two or more base stations, respectively in said each data field.
[Claim 25] The approach according to claim 24 of containing further the step which adds the active set data field which at least one of a current active set, the past active set, and future active sets can identify to said message.
[Claim 26] Said pilot wave is an approach according to claim 1 transmitted on two or more carrier signals.
[Claim 27] Said two or more carrier signals are approaches according to claim 26 transmitted from the corresponding antenna of a configuration of that plurality differs.
[Claim 28] Two or more base stations which transmit each code channel which contains a forward traffic channel with each pilot wave, System control station connected to said two or more base stations possible [a communication link] In the communication system which consists of a mobile station which has said two or more base stations assigned to the active set Said mobile station Diversity receiver which measures each signal quality of said pilot wave Signal quality criteria are generated. Processor which prepares the message which shows which [of said signal quality of said pilot wave] is equal to said criteria, or whether it is over it Said message to said system control station Direct, Or it consists of a migration transmitter transmitted via said two or more base stations. Communication system with which said system control station adjusts the transmitted power level of said forward traffic channel according to reception of said message.
[Claim 29] Said processor of said mobile station Threshold generating mechanism which generates a threshold signal as said criteria based on at least one of said the pilot waves who cover the time interval decided beforehand and have the greatest measurement-signal quality Communication system including a comparison mechanism [said threshold signal / signal quality / said / of said pilot wave / each] according to claim 28.
[Claim 30] Said processor of said mobile station is communication system including the message formatting mechanism which generates the bit vector containing the index which identifies which shall have the greatest measurement-signal quality between the list of values which means [whether each signal quality of said pilot wave is equal to said threshold signal, and] whether it is over it, and said pilot wave in said message according to claim 29.
[Claim 31] Said migration transmitter is CDMA. It is the communication system according to claim 29 which transmits said bit vector at least at once about all the frames of an IS-95 protocol.
[Claim 32] Said migration transmitter is CDMA. Communication system of the frame of an IS-95 protocol, and the part of a frame according to claim 30 with which only a multiple transmits said bit vector at least.
[Claim 33] Said diversity receiver Pilot receiver which measures said each signal quality of said pilot wave Communication system according to claim 28 which consists of a finger of N individual where each receives at least one of said the code channels via at least one of direct pass and the multi-passes from a base station.
[Claim 34] Said processor The allocation mechanism which assigns the finger of said N individual to the subset of said at least one N of said code channel which shows a larger signal pair interference ratio than all other signals corresponding to said code channel, the index which identifies which shall have the greatest measurement-signal quality between the list including the value showing whether each of said pilot wave corresponds to said subset of said at least one N of said code channel, and said pilot wave Communication system including the message formatting mechanism given into a message according to claim 33.
[Claim 35] Said two or more base stations are the communication system containing two or more sectors respectively transmitted to the area which had each of said pilot wave and said

each code channel chosen, and which separated geographically according to claim 28.
[Claim 36] Said system control station The control processor which determines which [of said signal quality of said pilot wave shown in said message exceeding whether to be equal to said signal quality criteria and it] corresponds to which subset of two or more of said base stations, by controlling the code channel power level of said subset of two or more of said base stations determined by said control processor Communication system including the control signal formatting mechanism which forms the control signal notified to said two or more base stations for controlling forward traffic channel power allocation according to claim 28.
[Claim 37] Said message formatting mechanism The receiving mechanism which receives the hand off instruction message identified in the sequence that said two or more base stations were able to be beforehand decided in said active set, Each data field about each of two or more of said base stations corresponding to said sequence is arranged. Communication system according to claim 30 which consists of an array mechanism which arranges said value which shows whether said signal quality of said pilot wave is equal to said threshold signal, or exceeds it in said each data field corresponding to said sequence.
[Claim 38] It is equipment which changes forward traffic channel power allocation. A means to measure each signal quality of the signal transmitted from two or more base stations, A means to generate signal quality criteria based on said signal quality measured by said measurement means, A means to generate the bit vector which lists said base station which has the measurement-signal quality beyond said criteria in case each base station is in the active set of a mobile unit, Mobile unit which consists of a transmitter which transmits said bit vector Equipment including a means to adjust said forward traffic channel power allocation of two or more of said base stations based on said two or more base stations identified in said bit vector.
[Claim 39] Said processor Threshold generating mechanism which generates a threshold as said signal quality criteria based on at least one of said the pilot waves who cover the time interval decided beforehand and have the greatest measurement-signal quality From a comparison means [said threshold signal / signal quality / said / of said pilot wave / each] to equipment according to claim 38
[Claim 40] Said measurement means contains the diversity receiver which has n fingers The decision mechanism as which said processor determines whether at least one finger of said diversity receiver is assigned to code channel signaling from the base station is included Equipment according to claim 38 with which said bit vector generating means lists the base station which gives each code channel signaling assigned to said at least one finger.
[Claim 41] Said signal is equipment according to claim 38 which consists of a carrier signal from which plurality differs.
[Claim 42] The carrier signal from which said plurality differs is equipment according to claim 41 transmitted from the corresponding antenna of a configuration of that plurality differs.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to cellular communication system, the modification approach of forward traffic channel power allocation [in / more specifically / code division multiple access (CDMA) cellular communication system], and equipment.
[0002]
[Description of the Prior Art]
Since the common cycle numerical range band is generally mobile, in order that it may be used for the communication link to the set of a base station and may communicate from a base station to MOBAIRU in CDMA cellular communication system, generally other common cycle numerical range bands are used. In other examples, in order to communicate, the set of a common cycle numerical range band can be used. The main profits which transmit multiplex communication on a common cycle numerical range band are the increments in the capacity of a cellular telephone system. LS-95 specification specified by Telecommunications Industry Association (TIA) is the example of the air interface of CDMA of the high performance used in order to carry out a cellular telephone system.
[0003]
The set of the communication link carried out on the cycle numerical range band same in CDMA cellular communication system is distinguished after dissociating mutually by getting over after modulating the data transmitted for the both sides of reception and a transmitting system using the false random-noise (PN) code which is known. Other communication links appear as a background noise during processing of all specific communication links. Since other communication links appear as a background noise, in order that they may use an available cycle numerical range band more efficiently [a CDMA protocol like IS-95], extensive transmitted power control is often used. Transmitted power control holds down communicative transmitted power to the minimum, in order to communicate exactly. Transmitted power control makes processing of a communication link of all specification easy by lowering the level of the background noise generated by other communication links.
[0004]
it is being able to use for also obtaining ** which makes it transmit to a base station with the 2nd cycle numerical range band since mobile [make transmit to MOBAIRU on the same cycle numerical range band from base station transmission and], and one profits making MOBAIRU transfer to the coverage area of the 2nd base station from the coverage area of the 1st base station using a "software hand off." A software hand off is a process which makes MOBAIRU coincidence interface with two pieces or the base station beyond it. A software hand off can be made to contrast with a hard hand off while an interface with the 1st base station is closed before an interface with the 2nd base station is established.
[0005]
Although it is obvious **, since connection of a piece is always maintained at least, generally the software hand off is stronger than a hard hand off. The approach and system for carrying out the software hand off in a CDMA cellular telephone system Both sides are transferred to the

grantee of this invention, and are incorporated by citation in this invention by the citation. U.S. Pat. No. 5,101,501 for which it applied on November 7, 1989 entitled "the approach and system" for offering the software hand off in a CDMA cellular telephone system, and a communication link, It is indicated in U.S. Pat. No. 5,267,261 entitled "the mobile station supported by the software hand off in CDMA cellular communication system."
[0006]
After each base station obtains early system synchronization according to the software hand off procedure currently explained in the patent quoted above, in order to offer the powerful time amount of a signal, frequency, and phase trace which were transmitted to the cellular site, the related pilot channel used more mobile is transmitted. Although a common diffusion code (namely, false noise sequence) is used for the pilot channel transmitted by each base station, different code phase offset is used for it, and it enables it to distinguish the pilot channel transmitted from the base station where a mobile station is related.
[0007]
Two pieces or the base station beyond it transmits the same forward link data mobile between software hand offs. A signal is compounded after receiving the signal from the set of mobile ** and a base station. The approach and the equipment for compounding are transferred to the grantee of this invention, are entitled "the diver city receiver in a CDMA cellular telephone system" incorporated in this specification by the citation, are explained into the United States patent number No. 5,109,390 for which it applied on November 7, 1989, and are indicating the diver city composition approach for use in a CDMA cellular telephone system.
[0008]
While a software hand off offers more powerful connection, in some examples, a software hand off does a bad influence to the capacity of the whole CDMA cellular telephone system again. It is because the transmitted power of the whole used for this carrying out the communication link to which the multiplex forward link transmission generated between software hand offs is equivalent is increased. The transmitted power which increased increases the background noise of the whole generated by the system, and decreases the capacity of the whole system on the other hand.
[0009]
It is influenced by the environment generally put between mobile ** software hand offs whether a software hand off increases the capacity of a system or it is made to decrease. it is mobile — when put to the environment of fading, since a signal generally decreases the diversity which was brought about by the software hand off and which increased according to an individual, generally it is advantageous to the engine performance of a system. it is mobile -- when it is in a non-fading environment, generally the diver city of a data source is redundancy-like. Therefore, as for the profits brought about to the non-fading environment by the diver city to which the signal source increased, a software hand off does not have phase murder of increase of the whole transmitted power of a cause.
[0010]
[Problem(s) to be Solved by the Invention]
Therefore, the place which this invention means is improving the engine performance of CDMA communication system by optimizing the gestalt of the CDMA communication system between the software hand offs in the both sides which answer the environment the communication link in a multiplex subcarrier environment being carried out.
[0011]
Therefore, one of the purposes of this invention is offering the new approach for reducing the amount of the whole forward traffic channel power which receives mobile between software hand offs. Another purpose of this invention is offering the system which performs the aforementioned approach. another purpose of this invention is mobile -- it is determining the environment which operates between software hand offs, and optimizing the gestalt of a software hand off corresponding to this decision. This invention is applied to a multiplex subcarrier forward link again. Therefore, one of the purposes of this invention is offering the new approach for reducing the amount of the whole forward traffic channel power transmitted mobile by the multiplex

subcarrier forward link. Another purpose of this invention is offering the system which enforces the aforementioned approach. Another purpose of this invention is determining the environment which is carrying out mobile ****** and optimizing the gestalt of a multiplex subcarrier forward link corresponding to this decision.
[0012]
This invention is applied to the system which uses the both sides of a software hand off and a multiplex subcarrier forward link.
[0013]
[Means for Solving the Problem]
this invention is mobile — an approach and a system with the freshness transmitted to the system control station in which the pilot wave from each base station in the "active set" of the pilot channel which was able to catch the bit vector message more mobile is quantified frequently, and the quality (for example, signal pair interference ratio) of the measured signal is shown are offered. After generating a bit vector message under supervising the quality of the signal with which mobile ** and a pilot wave are related and transmitting the quality of a related pilot channel to the base station where it is related in the active set of migration of a bit vector message as compared with a criterion, the information in a bit vector message is sent to the control unit of a system. Corresponding to this, the control device of a system emits a command to the base station in a mobile active set, and adjusts one as which the code channel power with which a base station is related was chosen according to the quality of a related pilot channel reported in the bit vector message generated more mobile.
[0014]
Since a forward traffic channel consists of the code channel to which the base station in a mobile active set relates, reduction of the transmitted power of a related code channel reduces the power with which the forward traffic channel was transmitted. Therefore, the capacity of the whole CDMA communication system increases as a result of the minimum radiation which forward traffic channel power required for right reception in a mobile place takes. By communicating the quality of the pilot channel observed quickly to the control unit of a system, a CDMA system re-optimizes the system source quickly corresponding to an environmental change, and can make channel capacity the maximum.
[0015]
In another operation gestalt of this invention which uses a multiplex subcarrier link, a mobile station transmits a bit to each subcarrier, or instead transmits a bit at all antennas. Furthermore, a base station adjusts power according to an individual on each subcarrier.
[0016]
[Embodiment of the Invention]
Although the communication system 2 which is a desirable cellular telephone system is shown in drawing 1 if the components with which a reference number is the same through two or more drawings with components, or corresponds about a drawing are shown and it says in more detail, it is equally [to public line exchange (PBX), a Personal Communication Service (PCS) system, a satellite communication system, an inside-of-a-house wireless network, or an outdoor wireless network] applicable. This system 2 uses a code division multiple access (CDMA) modulation and a recovery technique for the communication link between system resources. There are the interface and processing circuit where a system enables it to control 1 set of base poles 12, 14, 16, 17, and 19 in the system control station (selector) 10 generally called mobile phone switch office (MTSO). A system control station 10 controls routing of telebrief to the base stations 12, 14, 16, 17, and 19 which correspond from a public telephone switched network (PSTN), in order to transmit to the corresponding transmission place again. Are in PSTN or the connection from PSTN may be any of wireless, an optical fiber, or a "cable" (for example, twist paired-cable and coaxial cable) communication link. A system control station 10 communicates with a data network, a multimedia network, the local area network that, in addition to this, contains premises and a public correspondence entity, and a public correspondence network. Furthermore, a system control station 10 communicates with other base stations which are not shown in drawing 1 .

[0017]
A system control station 10 communicates with base stations 12, 14, 16, 17, and 19 with various means, such as for example, a leased telephone circuit, a fiber link, a coaxial link, or a radio frequency (RF) communication link. Base stations 12, 14, and 16 communicate by the alien system and single subcarrier wireless CDMA communication mode which are called a mobile station ("mobile"). Base stations 17 and 19 communicate with an alien system called a mobile station 21 by the multiplex subcarrier link which consists of three CDMA signals shown by arrow-head 26 a**c. A mobile station 21 communicates with base stations 17 and 19 by the single subcarrier reverse link 28. It cares about that a multiplex subcarrier forward link may consist of four or more subcarriers or two subcarriers or less. Drawing 1 indicates the direct diffusion system of the single subcarrier used more commonly to be the multiplex subcarrier which lives together in the same system again. Although such coexistence is possible, it cares about using the desirable forward link of a monotype [system].
[0018]
Arrow heads 20a and 20b are illustrating the reverse link and forward link between a base station 12 and a mobile station 18, respectively. Arrow heads 22a and 22b are illustrating the reverse link and forward link between a base station 14 and a mobile station 18. Similarly, arrow heads 24a and 24b are illustrating the reverse link and forward link which are considered between a base station 16 and a mobile station 18. Although the direct continuation or radio frequency connection with a mobile station 18 from each base stations 12 and 14, the crosslink between 16, or a control unit 10 are not shown in drawing 1 , such possibility is also included in the mode of this invention.
[0019]
If it is ordered a system control station 10 establishing base stations 12, 14, and 16 to the active set of a mobile station, and establishing an interface with the mobile station 10 concerned to allocation and each base station, base stations 12, 14, and 16 will put traffic data on the communication link forward links 20b, 22b, and 24b using the Walsh code channel, and will transmit it to a mobile station 18, respectively. The code channel assigned to the communication link with a mobile station 10 is also called a traffic channel. Redundancy (duplication) information is included in each code channel sent to the mobile station from a different base station, and a mobile station 10 combines each code channel using a diversity (this specification explains in more detail) composition mechanism using this. Although the forward link rate to a mobile station is raised, the multiplex code channel from the same base station can be used. In this case, the set of a code channel is called a traffic channel. A forward link signal has the subset of a traffic channel, and the set of the code channel containing auxiliary control channels, such as for example, a pilot channel, a synchronous channel, and a paging channel. This invention reduces the transmitted power of a forward link signal between software hand offs by reducing the time amount to which the traffic channel is active.
[0020]
Base stations 12, 14, and 16 transmit a pilot channel to a mobile station 18 again through the forward communication links 20b, 22b, and 24b, respectively. A pilot channel is distinguished from the traffic channel transmitted in Walsh code from the same base station. Each pilot channel from a different base station is mutually distinguished by pilot PN code shift. When there is neither Brock nor fading, it is expected that it becomes a bigger power signal than a base station 12 and the received signal power of 14 since the pilot channel which a mobile station 18 receives from a base station 16 has a mobile station 18 and a base station 16 in the location approached most.
[0021]
Or instead of using the code channel (Walsh code) which became independent to the pilot wave, it can embed at the traffic channel stream by which a pilot wave is seen off in each mobile station, or can multiplex. Embedding can be performed by using a special pilot symbol or an auxiliary signal. When using the embedded pilot wave, generally a pilot wave common to the first system prehension and the detection at the time of a hand off will be employed. Or it is each traffic channel unit, or another pilot wave can be transmitted per group of a traffic channel.

[0022]
When a mobile station 18 is in a software hand off field, a system control station 10 emits a hand off prompting message including the list of base stations to which the active set of a mobile station is assigned (for example, when moving to the coverage area of at least one another base station from the coverage area of at least one base station). The auxiliary information of the hand off threshold (for example, an addition threshold and a fall threshold) which is useful to a mobile station for example, after hand off operation is also included in the hand off prompting message again. The pilot wave from the base station used to establish an interface with a mobile station is contained in an active set as explained by the application and the IS-95 standard which were quoted previously. The pilot channel in which a mobile station has sufficient die length detected recently, and the pilot channel from the base station where it turns out that it is in the same geography field are contained in a candidate set.
[0023]
or [that which pilot channel tends to become appropriate strength] -- if it understands, required processing can be reduced with the mobile station of searching the near candidate set and active set of a mobile station frequently in quest of the pilot channel corresponding to a base station (namely, thing for which it knows which base station being assigned to the near candidate set of a mobile station).
[0024]
Drawing 2 is a graph observable from a mobile station 18 which shows the relative pilot channel quality from cels 12, 14, and 16 as it is shown in drawing 1 . the graph of drawing 2 -- the time amount of three instantiation pilot channels from base stations 12, 14, and 16 -- receiving -- the total received power in a mobile station 18 -- (-- energy (Ec) is plotted per PN chip of per Io). It is alike, therefore a signal quality deteriorates, and the pilot wave from a base station 16 shows the thing in which time amount passes and which the mobile station 18 is keeping away from the base station 16 as shown in drawing 2 . On the contrary, the signal quality of the pilot wave from a base station 12 improved with time amount progress, and it has suggested that the mobile station 18 is moving toward a base station 12. While the signal quality of the pilot wave from a base station 14 had been comparatively fixed, it is shown that the mobile station 18 is moving along the circumference of a base station 14.
[0025]
The area which poses a problem by drawing 2 is a software hand off field. In a software hand off field, it judges which base station a mobile station 18 and a system control station 10 have in the active set of a mobile station by communicating mutually based on the relative quality of the pilot channel of cels 12, 14, and 16. In the example of an illustration, since the level of the pilot channel from a base station 16 was over the addition threshold, the pilot channel exists in the active set of a mobile station at the beginning. However, at the edge of a software hand off field, over a certain time amount, the pilot wave from a base station 16 is less than a fall threshold level, and falls.
[0026]
In a response, a base station 16 is removed from an active set with a system control station 10 by the communication link to a system control station 10 from a mobile station using a pilot on-the-strength measured-value message. In order that the pilot wave from a base station 14 may never exceed an addition threshold level, a base station 14 is not added to an active set. By contrast, a base station 12 is added to an active set, when the pilot on-the-strength measured-value message which exceeds an addition threshold over required time amount, therefore a mobile station 18 generates is answered and it is judged by the system control station 10. Near the edge of a software hand off field, only the signal of a base station 12 remains in the active set of a mobile station 18.
[0027]
Even when the traffic channel to which the bad pilot channel of a receive state is equivalent has hardly affected the receiving quality in a mobile station, it is sometimes often detected that it is sufficient frequency to exceed a fall threshold and maintain a corresponding base station in an active set. In the case of a late fading environment, this is especially applied. In the case of a

late fading environment, the signal level received from the base station changes mutually slowly. Generally, signal level is strong and this reverse is also realized for the time being than base station where one base station is another. A fading rate is not sufficient speed to acquire the short-term advantage of a diversity. Therefore, it is desirable to transmit from a strong base station from a weak base station.

[0028]

This invention is investigating shortening the air time of the code channel from some base stations in a fading environment in order to reduce the total transmitting energy generated about a related communication link. If the total transmitting energy of a specific communication link is reduced, a system-wide capacity can be raised. The hand off procedure which excepts a base station from an active set can be used for it, and it should care about that transmitted power may be able to be reduced by it. This makes it difficult to change with transmission quickly from the base station, when the signal from other base stations turns into a strong signal more.

[0029]

Another example is a mobile station, and although the signal from a certain base station was received with signal level lower than another base station, when having still exceeded the fall threshold, it is an example to which this invention is useful. It is desirable to transmit only from the base station where a signal is more strongly received with a mobile station in the environment which does not almost have fading. However, if hand off procedure is used in order that a base station may separate from an active set and may return that base station to an active set after that, remarkable delay will be brought about when this pilot wave becomes strong. This delay decreases the quality of a link and makes a message fall.

[0030]

Drawing 3 is the block diagram of a mobile station 18. The antenna 30 is compounded by the analog receiver 34 and the transmitted power amplifier 36 through the diplexer. A diplexer 32 enables it to perform simultaneous transmission and reception through an antenna 30 in cooperation with an antenna 30. An antenna 30 receives the pilot [who receives RF energy from each base stations 12, 14, and 16] channel signaling by whom routing is done through a diplexer 32 on the other hand (drawing 1) to the analog receiver 34, and code channel signaling. The analog receiver 34 receives RF energy from a diplexer 32, and performs the open loop power control function which adjusts the transmitted power of a mobile station for transmission in a reverse link (from a mobile station to namely, a base station). A receiver 34 generates an analog power control signal, and this is sent to the transmitted power control circuit 38 as it is discussed by U.S. Pat. No. 5,056,109 which is included in this specification by indicating by reference here where it was transferred to the grantee of this invention and which was entitled "the approach and equipment" of transmitted power control with a CDMA cellular mobile phone system, if it says in more detail. It is transmitted by the forward link and a control processor 46 starts closed-loop power control adjustment using the reverse link power control bit stream to which it restores with digital data receivers 40, 42, and 45. The analog receiver 34 changes received RF energy into baseband signaling, and digitizes baseband signaling.

[0031]

The digital data receivers 40, 42, and 45 with which the output digitized from the analog receiver 34 operates according to control of search receiver 44 HE ****** and a control processor 46 receive the code channel from each base station, and each output is sent to a diversity composition machine / decoder 48. A diversity composition machine / decoder 48 compounds each output signal from receivers 40, 42, and 45 later based on the synthetic selected scheme discussed in a detail.

[0032]

Although three digital data receivers 40, 42, and 45 are shown in drawing 3 , generally the diversity composition machine / decoder 48 is formed for the interface with some additional digital data receivers. Preferably, as for the number of the digital data receivers contained in a mobile station 18, it is desirable that it is equal to the maximum number (the independent direct signal and independent multi-pass signal which are generated from each code channel are taken into consideration) of the code channel which a mobile station adopts by the synthetic scheme.

By including an additional data receiver, additional diversity gain is possible and this invention can be applied to the digital data receiver (or signal multi-channel digital data receiver) of the number of arbitration as it will discuss from now on.

[0033]

Digital data receivers 40, 42, and 45 form "lake" receiving structure in cooperation with a diversity composition machine / decoder 48. A diversity composition machine / decoder 48 cooperates with the receivers 40, 42, and 45 which play the role of three fingers in a lake, respectively. If it says in more detail, receivers 40, 42, and 45 can be set up with a control processor 46 so that the multi-pass signal from the code channel or the common base station from a different base station can be received. It can use for this receiving the code channel from three base stations which are different altogether in three sets of receivers 40, 42, and 45, or one code channel (namely, three multi-pass signals) from one base station at which it arrives via three different signal pass. It is clear that the combination of the arbitration of the multi-pass from a different base station and a code channel is receivable using receivers 40, 42, and 45. For example, based on the combination of some single channel receivers, a multi-channel receiver (that is, it has at least one channel), and a diversity composition machine, much other configurations can carry out lake receiver structure. Furthermore, the function of a diversity composition machine is incorporable into one of a control processor 46 or the receivers 40, 42, and 45.

[0034]

With a desirable operation gestalt, the output of a diversity composition machine / decoder circuit 48 is sent to DEINTARIBA and a decoder. Generally the output of a decoder passes the control unit which divides a receiving data stream into end user data and control data. End user data are offered to a data device like a voice coder.

[0035]

The data output of a data device, for example, a voice message identification code, is transmitted to the base station in a mobile station active set through a reverse link. It is baseband signaling, and the output of the user digital baseband circuit 50 is formatted, decrypted and interleave-ized, it is sent to the transmitting modulator 52 and modulated. The output of the transmitting modulator 52 passes the transmitted power control device 38 under control of a control processor 46. The transmitted power control circuit 38 adjusts the output power of a mobile station 18 based on the power level signal which the analog receiver 34 and a closed-loop power control bit offer, an output RF signal amplifies this output signal, it passes along the diplexer 32 HE **** transmitted power amplifier 38, and the amplified output signal is transmitted from an antenna 30.

[0036]

The code channel signaling and the pilot wave who transmitted with other CDMA signals which the base station in a pilot wave's active set commits as interference to a mobile station 18 are contained in the IF signal digitized from the analog receiver 34. The function of receivers 40, 42, and 45 is taking correlation with suitable PN sequence and IF sample. This correlation process offers the "processing gain" which raises the signal pair interference ratio turned to a mobile station by having consistency with PN sequence used to encode the message sent to a mobile station by each code channel. The signal which is not encoded using PN sequence to match and whose intention it does not have "is diffused" according to a correlation process, and the signal pair interference ratio of the signal whose intention it does not have falls. This correlation output uses a pilot subcarrier as subcarrier phase criteria, and is detected coherent. The result of this detection process is the data symbol by which a single string was encoded.

[0037]

The search receiver 44 under control of a control processor 46 scans the pilot channel and multi-pass pilot channel which were received through direct pass and reflective pass (for example, multi-pass) from the base station. Receiving pilot energy (Ec) is used for the scanner receiver 44 per [to the total receiving spectral density, noise, and signal which are indicated to be Ec/Io as a receiving pilot wave's quality] chip. A receiver 44 provides a control processor 46 with the signal strength measured-value signal which shows each pilot channels and those

strength.
[0038]
The timing of the input signal by which an alignment input is carried out is adjusted, and a diversity composition machine / decoder circuit 48 aligns it, and adds them collectively. The multiplication of the weighting factor which ****s in the relative signal strength of the pilot channel corresponding to each input before this addition can be carried out to each input signal. Since it is presumed that each pilot wave's signal quality is equivalent to the quality of the signal transmitted by the code channel of each base station, a weighting factor is based on pilot reinforcement. When using a weighting factor, a synthetic vessel performs the diversity composition scheme of the most effective ratio. Next, the composite signal stream obtained as a result is decrypted using the forward stream error detection decoder contained in the diversity composition machine / decoder circuit 48. The weighting approach of the pilot base often works, when the base station in an active set transmits code channel signaling to a mobile station at a rate equal to a pilot signal. That is, the ratio of the code channel power to pilot power is the same with all the members of an active set. When this ratio is not the same, other weighting approaches may be desirable. For example, a base station can transmit the ratio of a traffic channel [as opposed to pilot channel power in all the base stations in an active set] to a mobile station with the means of a signaling message or others. If the relative fraction to a base station j is alphaj, a mobile station can compound a code channel using weight root (alphajgammaj). gammaj is the relative received power in a receiving-base station j pilot wave's mobile station here. As an option, a mobile station can presume alphaj or alphajgammaj from the input signal from a base station j.
In addition to this, there is a baseband processing facility in the baseband circuit 50 with a voice coder (vocoder) data interface. Furthermore, the user digital baseband circuit 50 interfaces with I/O circuits, such as an earphone which inputs a sound signal into a digitizer and the vocoder (voice coder) contained there. The output of the user digital baseband circuit 50 is offered to the transmitting modulator 52, a coded signal is modulated to PN carrier signal, and PN sequence corresponds to the address function assigned about the message to leave. By the control processor 46, a base station (12, 14, or 16) transmits, and this PN sequence is defined from the message setup information which a receiver (40, 42, or 45) decrypts.
The output of the transmitting modulator 52 is sent to the transmitted power control circuit 38, and signal transmitted power is controlled by the analog power control signal offered from a receiver 34 there. Furthermore, a control bit is transmitted by the base station in the form of a power adjustment command, and the transmitted power control circuit 38 answers it. The transmitted power control circuit 38 sends the signal become [power control] irregular to the power amplification circuit 36. The power amplification circuit 36 amplifies the modulated signal, and changes it into RF frequency. The amplifier which amplifies the power of the modulated signal to final output level is contained in the transmitted power amplifier 36. The amplified output signal is sent to the diplexer 34 to base stations 12, 14, and 16 which compounds a signal to an antenna 30 for transmission after that. Base stations 12, 14, and 16 receive the signal for a system control station, and it is sent to the system control station 10 with which these signals are compounded, respectively.
[0039]
Drawing 4 is the graph of the diversity receiver engine performance measured as a probability of a framing error rate over Eb/No in case a diversity receiver performs rate composition of optimum ratio. Four instantiation-curves which show the probability of a framing error rate are shown about the migration receiver constituted so that a finger might receive the signal corresponding to three (M= 3) in 2 (M= 2) and a finger from the base station of the number corresponding to [finger / 1 (M= 1) and] the number of each four fingers (M= 4) in a finger. If the curve of M= 1 is compared with the curve of M= 2, it has two fingers and the engine performance of the receiver which processes the pass of two is superior to the engine performance of the receiver which processes the pass of one. This comparison is performed by investigating the distance between each framing error probability curve about the given framing error rate (namely, broken line). An improvement of the engine performance is shown by distance

M1-2 in a typical graph. Similarly, when a mobile station uses the diversity receiver of three fingers, the engine-performance improvement of M2-3 is attained. In that case, generally M2-3 are smaller than the engine-performance improvement of M1-2. If 4 Motome's finger is similarly added to a diversity receiver, an engine-performance improvement as shown by M3-4 will be attained. M3-4 should care about that it is smaller than M2-3 and M1-2. Thus, when a mobile station is a mobile station only in a CDMA system, the diversity receiver which has the finger of many numbers increasingly and receives the transmission from the base station of the number corresponding to the number of fingers will make an engine-performance improvement continuously, even if M becomes a large number and an improvement becomes only small. Furthermore, it is assumed that no finger contributes the relation about said engine performance only to the noise to a synthetic process. It depends for the absolute magnitude of an improvement on communication link conditions (for example, the amount of fading, the class of fading, impulsive force of a noise, contiguity to a base station, etc.).

[0040]

Among a software hand off, by utilizing a diversity composition process for a forward link and a reverse link, system capacity differs and is influenced. For example, by the reverse link, a mobile station is respectively transmitted to base stations 12, 14, and 16 through Pass 20a, 22a, and 24a (drawing 1). Each of a base station compounds each signal with which this was prepared in delivery and this by base stations 12, 14, and 16 to the system control station (selector) 10 using the diversity composition process in response to the transmission from a mobile station 18. Since only one mobile station 18 has transmitted, system capacity does not receive a bad influence by using diversity composition.

[0041]

However, a mobile station 18 makes a different signal (it has the encoded same information altogether) transmitted from base stations 12, 14, and 16 compound by the forward link. It is chosen for gain composition, such as the maximum ratio composition, and processing of one signal, and various synthetic approaches including simple selection by which other signals are canceled are learned for the industry. It is because transmission of the addition from the base station where it to which the overall system capacity of a CDMA system may be reduced in fact is communicating to the 1st mobile station appears as background interference to the 2nd mobile station although it is that preparing the base station of a number excessive probably of the addition to the active set of a mobile station raises the engine performance which surely is seen with the mobile station. It depends for the usefulness of a specific code channel on the various elements containing the reinforcement to the code channel from other base stations.

[0042]

If there is sufficient gain for a diversity, the sum total power emitted with CDMA communication system will become typical more small. However, as it accepted by this invention, even if it does not need the diversity of a metaphor addition, the total power emitted is typically large rather than it is needed for the appropriate engine performance. About whether the increase or reduction of electric energy emitted from each of a base station is influenced, it is dependent on the property of the transmitting way between a base station and a mobile station. According to 1 operation gestalt of this invention, the total transmitted power from a CDMA system is set as the much more optimal point of application by increasing correspondence with a mobile station 18 and a system control station (selector) 10. It describes below how the information to need is collected with a mobile station so that a system can operate by still higher capacity.

[0043]

Drawing 5 is the graph of the Ec/Io pair time amount of the software hand off area where three pilot waves A, B, and C from each base station are contained in the active set of a mobile station. between software hand off area, change of each communication channel of pilot waves A (a dotted line shows), B (a broken line shows), and C (a continuous line shows) causes change of signal strength so that it may see from drawing 5 -- making -- and -- therefore, the ratio of a signal pair noise is changed and each pilot waves A, B, and C are fluctuated. These fluctuation gives big possibility of raising diversity gain, and it teaches how this invention raises diversity gain in order to make system capacity the maximum by changing power allocation of a forward

traffic channel in a quick form.
[0044]
In relation to the signal of others any one of Signals A, B, and C, SNR changes so that pilot waves' A, B, and C relative pilot quality reinforcement (pilot quality) may change from a frame to a frame and may be seen from drawing 5 . For example, with the 1st frame, although a pilot wave A gives the greatest SNR, a pilot wave B gives the minimum SNR. However, with a frame 2, pilot waves' B and C correspondence signal-to-noise ratio carries out a crossover (it is shown in drawing 5 like) crossover, and a pilot wave's B SNR is larger than a pilot wave's C SNR at the edge of a frame 2.
[0045]
Although drawing 6 is the same as that of drawing 5 , deltar expresses the fixed level delta under the strongest S/N of the pilot waves B and C of the active set of a mobile station among drawing containing level deltar (a crossover "x" line shows) calculated by control PUROSSESSA 46 (drawing 3) of a mobile station 18. Preferably, in order to decompose a pilot wave's relative signal quality still more finely, various deltar (namely, two or more delta) may be used for deltar so that gradual delta may be used. A control processor 46 may make setting deltar which calculates threshold signal deltar continuously preferably and which is a substitute individual exception, of course, or was sorted out.
[0046]
As shown in drawing 6 , between the 1st frame, a pilot wave A is above equivalent to threshold signal deltar, or this, and this is set up by the pilot A itself by this example (that is, the pilot wave A has strongest SNR and, so, deltar is based on level deltadB below SNR set up by the pilot wave A). Moreover, there are no signals B and C above signal level deltar, an EQC, or this. Therefore, in the frame 1, it is above this and, as for drawing 6 , the pilot wave (the alphabetic character "A" written on the top of [time amount] shaft of the 1st frame shows like) A shows equivalent to signal deltar, or that it has the greatest average SNR to the past frame spacing. With a frame 2, strongest SNR is the thing of Signal A and, subsequently it is a pilot wave B, and the lowest pilot wave is C and the all are higher than deltar at the edge of a frame. With frames 3 and 4, only pilot waves A and B have come above deltar. With the frame 5, the pilot wave C has strongest SNR (so, deltar is calculated based on a pilot wave C). Subsequently, a pilot wave A is the strongest following signal, and it is larger than a pilot wave's B SNR, and those all are above deltar.
[0047]
The mobile station is collecting a lot of information effectively about the specific communication channel in a predetermined frame by calculating deltar by comparing deltar with each of each signal from the base station of an active set. In order to detect the signal transmitted from each base station the optimal, by designing the diver city receiver and the synthetic vessel of a mobile station, this characterization of a communication channel is utilizable with a mobile station. Furthermore, according to the operation gestalt of this invention, the engine performance of CDMA communication system is also optimized by communicating the quality of a pilot wave's best signal within an active set so that adjustment with a system control station equivalent about power allocation of the forward traffic channel between the base stations in an active set can be performed. it is shown in drawing 5 -- as -- the relativity of the signal from each base station -- since the number and selection with the optimal transmitting base station are not no longer fixed when SNR changes from a frame to a frame quickly, information communicates quickly to a system control station 10 (drawing 1).
[0048]
Moreover, delta value used in order to calculate deltar is saved beforehand at the mobile station, or it should be agreed a signal message or that some can be sent to a mobile station by other control approaches. Moreover, please agree that drawing 5 and drawing 6 are described in the sense of the frame corresponding to the frame used for a traffic channel data framing, interleaving, and in order to carry out encoding as described by the IS-95 standard. However, it may not be required of this invention, and the frame shown in drawing 5 and drawing 6 may not be equivalent to specific processing spacing at all, and, as for this, may be short longer than the

illustrated value for 20ms. Furthermore, the various transmission described above is generated by different base station. However, this invention is applicable also to the component which emits a forward link signal. Especially this invention is applied also to the antenna with which the same base stations to which the same signal is emitted differed. For example, the signals A, B, and C of drawing 5 and drawing 6 can also be taken out from the antenna with which the same base stations differed to one base station like [in case there are three antennas].

[0049]

Moreover, it should also be agreed that the set of the signals A, B, and C shown in drawing 5 and drawing 6 can be made into the thing from the combination of a base station or an antenna, or the combination of the antenna of one base station. For example, Signals A and B can be made into the thing from two different transmitting antennas of a base station 17, and Signal C can also be transmitted from a base station 19. Signals A, B, and C can also be made into the signal from a different antenna which may be the multiplex subcarrier forward link altogether transmitted from the same base station, or emits a multiplex subcarrier forward link. For example, supposing a base station 17 transmits three subcarriers from two antennas, Signal A consists of two subcarriers and Signal B consists of one subcarrier. By this example, although Signal A consists of two another different carrier signals, both will be emitted from the same antenna and these subcarriers will essentially be received by the mobile station on the same level, if transmitted on the same level. Moreover, it is also clear that there is a signal of three or more a large number which the mobile station is pursuing (shown in drawing 5 and drawing 6) in an actual system.

[0050]

In order to give this information quickly to a system control station 10 (drawing 1), this invention gives a new communications protocol between the mobile stations and system control stations 10 which were discussed on these specifications with reference to drawing 7 A - 7C. signaling in the form of a bit vector message where drawing 7 A - 7C was reported to the system control station (selector) 10 through the reverse link signal transmitted to the selector 10 by one or the base station beyond it (12 and 14) from the mobile station 18 -- or the form of control messaging is shown. Although the much more frequent report and the report as for which between was further vacant in the list are also made into the alternative means, a bit vector message is preferably transmitted for every frame.

[0051]

With 1 operation gestalt of this invention, the multi-channel reverse link signal consists of the code channel the channel and the lot defined in Walsh code of a lot by the same approach as a forward link cross at right angles. In order to make into min a time delay until a system control station can act on the information included in a bit vector message in a setup of this multi-channel reverse link, as for a bit vector message, it is desirable to communicate through one of the code channels channels and a reverse link cross at right angles. The system and approach of transmitting data using such a reverse link signal are described for the United States patent application numbers 08/654,443 of the coincidence presentation entitled the "high data rate CDMA radio communications system" which it is transferred to the grantee of this invention of presentation on May 28, 1996, and have been included in this specification for reference.

[0052]

With another operation gestalt of invention, the reverse link signal of a single code channel is used as used for the IS-95 standard system. A data vector is transmitted to a bit vector message with other desirable user data within a single code time amount multiplexing or by carrying out bit blowout tea and making it a reverse link PN code.

[0053]

Drawing 7 A shows the DS of the pilot quality bit vector message which was started by the mobile station and transmitted to the system control station 10 through the base station. Especially drawing 7 A has short die length, and shows 10 bit-vector message which can be reported to the system control station 10 with the quality of the signal which moreover became among the pilot waves of the active set of a mobile station more than a fixed criterion (for example, deltar threshold signal of drawing 6), or it. It may be other desirable however formats

of those other than a bit vector for a bit vector message not to be limited to 10 bits, and to have a short message. In order to reduce the number of the transmitted bits, the bit vector message considers the arrangement of each pilot channel based on the sequence of a pilot wave's beginning checked from the system control station by the hand off instruction message to the mobile station.

[0054]

CDMA An IS-95 standard can be permitted to six members (pilot wave) in an active set, and those all can be put into a pilot quality bit vector message. In drawing 7 A, it is checked by the triplet data field index with which a pilot wave with the best thing (namely, the highest signal pair interference ratio) judged according to the process described with reference to drawing 6 checks specifically the location first reported to the mobile station by the hand off instruction message. An index is shown by the triplet data fields I1, I2, and I3 by drawing 7 A. In this way, if the pilot channel from the 2nd base station reported to the mobile station by the last hand off instruction message is received by the greatest SNR, a triplet index will be set to 2 (if binary 010), or it will be set to 1 supposing an index moves from 0 to 8.

[0055]

Bit fields U1, U2, U3, U4, U5, and U6 show whether the pilot channel which says each pilot wave first hung up by the hand off instruction message, and corresponds was respectively received above deltar threshold signal. For example, the bit of data field U1-6 is set to 1 (or 0), the pilot channel corresponding to the bit position is equal to deltar threshold signal, or being received more than by it is shown in the system control station 10. If U1 is especially set to 1, the 1st pilot wave of a system control station 10 checked by the last hand off instruction message being equal to deltar calculated by the control processor 46 in the signal-to-noise ratio in a mobile station, or having a thing above it will be admitted. U2-6 are preferably set on the basis for every frame by the processor 46, and they are transmitted to a system control station through the base station of a bit-vector message.

[0056]

It is the sequence number of the element of the last of a data field, Hm, and a ** hand off instruction message. A data field Hm is used in order to give the check of the active set which the mobile station is referring to to a system control station 10. Die length of Hm may be several bits, or it may be a single bit. In the case of a single bit, Hm may be the bit of the last of a sequence number. In this way, if the hand off instruction message in which the mobile station returned 1 by Hm supposing it was referring to the hand off instruction message of a sequence number 101, and it had a sequence number 100 if the hand off instruction message which ranked second equally to 100 which the base station sent, and had the sequence number of the number of 101 binaries was transmitted is referred to, 0 will be returned by Hm. By including a sequence number, base stations are the triplet data fields I1, I2, and I3, and it can be determined positively which pilot wave the mobile station is referring to by sets U1, U2, U3, U4, U5, and U6.

[0057]

With the operation gestalt of this invention including a multiplex subcarrier forward link, bit vectors U1, U2, U3, U4, U5, and U6 can be extended to a NxM bit, and there is a possible base station of N individual in an active set in that case, and there are M possible antennas in a base station. Or M can also be made equivalent to the number of the possible multiplex subcarrier forward links in a base station. the strongest thing of the NxM multiplex subcarrier forward link whose mobile station had vectors I1, I2, and I3 (it may need to check the largest thing among NxM items still longer) with this operation gestalt -- reporting -- **** -- moreover, the vector Ui -- using -- which -- others -- it reports whether a multiplex subcarrier channel is above deltar. another operation gestalt -- a mobile station -- Vector Ij -- using -- the base station rather strongest than the strongest subcarrier -- reporting -- subsequently -- Vector Ui -- using -- which -- others -- it reports whether a multiplex subcarrier channel is above deltar.

[0058]

deltar -- the strongest base station -- being related -- or it should be further careful of whether for it to be the strongest subcarrier among all the base stations of the active set of a mobile station, and to obtain. It should be further careful of the ability of the strongest base

station to be determined by totaling pilot Ec/I0 from all the forward link subcarriers of a multiplex subcarrier base station as are used in common by IS-95, and carried out of the multi-pass component from the same subcarrier. In this way, the reinforcement of the sum total of a base station is obtained by totaling Ec/I0 from all the multi-pass components of all forward link subcarriers and a specific subcarrier.

[0059]

A bit field message is answered, a system control station 10 receives the measured power message, and it is determined which to remove from a forward traffic channel among the signals of an active set so that this specification may discuss, and which is made to continue transmitting among base stations. That is, it checks whether the system control station 10 has transmitted the signal with which which base station is received below deltar threshold signal using the bit field message. If it directs that it stops that a system control station 10 transmits the traffic channel turned to the mobile station corresponding to the base station checked next and it is done so, the mobile station will lower the transmitting force of the forward link signal generated by these base stations. With another operation gestalt, a base station determines whether instead of a system control station, a message should be received and it should transmit a forward link. This approach reduces delay, however since all base stations (or base station which has transmitted the forward link) may not receive reverse link transmission, dependability may be thin [an approach] when the mobile station is a software hand off.

[0060]

A base station answers by not transmitting a traffic channel among the frame next to the data turned to the corresponding mobile station. Since the signal from the checked base station is received by the mobile station 18 by low SNR more remarkable than other at least one forward link signal, the increment in the error rate of a mobile station is small in proportion to the fall of the transmitting force of all systems. Even if it stops that the checked base station transmits a traffic channel, the signal process source in those base stations remains assigned, and if there is a demand by the system control station 10, it is ready to begin to transmit a traffic channel. Moreover, these base stations continue processing the reverse link signal preferably transmitted from the mobile station 18.

[0061]

A mobile station 18 continues supervising the related reinforcement of the pilot wave who received from the base station of an active set as a communication link continues. If a pilot wave's condition changes, for example a pilot wave will receive the signal above deltar threshold, a mobile station 18 will show that this change is just, and will generate another bit field message. A mobile station 18 will generate a bit field message, if a pilot channel with the best SNR changes again. According to a situation, it is directed whether a system control station 10 suspends that it is begun whether to transmit a traffic channel and transmission of a traffic channel to the mobile station in a base station with the active set from which the bit field message was received and the situation changed. each base station answers transmitting the following data frame via a traffic channel, if come out and it is so that directions may begin transmission, or by not transmitting the following data frame, if come out and it is so that directions may suspend transmission of a traffic channel.

[0062]

With another operation gestalt of invention, a mobile station 18 generates a bit field message once per each frame periodically. By maintaining the source assigned in each base station for transmitting a traffic channel, a traffic channel can be inactivated in response to the situation of it being activated quickly and changing quickly.

[0063]

With still more nearly another operation gestalt of this invention, the system control station 10 includes the gain control field in the nucleus data frame sent to the base station. The gain control field shows the transmitted power gain to which a frame should be transmitted from a base station. When a system control station 10 receives the vector which shows that the pilot channel from a specific base station is received below deltar threshold signal lower than the strongest pilot channel, the gain control of the following frame turned to the subscriber is

lowered. When much more many vectors show that the pilot channel from the base station stops at deltar threshold below the strongest pilot wave, a subsequent frame can be reduced further.
[0064]
Since a control system 10 defines better the stability of the environment where the mobile station is operating again, it may perform analysis to which the bit vector which received progressed further. Especially the control system 10 may supervise the rate which changes from the place which has a specific pilot channel above deltar threshold or in the bottom. If rate of change exceeds a predetermined threshold, since the mobile station has disappeared or a control system 10 is in an unstable environment, it is decided that it will be making the signal from each base station of a software hand off transmit succeedingly. Even when a control system 10 is compared to all the base stations by which the active set is carried out when such decision is made, and deltar threshold with a certain pilot channel lower than the best receiving pilot channel is detected, it directs to transmit a forward link traffic channel succeedingly.
[0065]
Drawing 7 (B) shows another DS of the pilot quality bit vector message transmitted to the system control station 10 through the base station from the mobile station. However this another operation gestalt is the same as the DS defined as drawing 7 A, 5 bits which checks 6 members of an active set are only included. Only 5 bits is used, because it is because the 6th check (namely, base station which gives the strongest S/N) is checked by the triplet of the beginning of a pilot quality bit vector message (namely, I1-3). By checking the strongest signal of the triplet of the beginning of a pilot quality bit vector message peculiar, a tacit understanding of not carrying out carrying out the bit check of the location of the strongest base station is carried out, and each of other members of an active set is serially checked by the bit of the after that of a pilot quality bit vector message.
[0066]
Drawing 7 C shows a format of still more nearly another pilot quality bit vector message which checks the strongest pilot wave of the base station of an active set, the following triplet strong against the second, J1-3 and a member's triplet strong against the third, and K1-3 peculiar using triplet I1-3 of the beginning. In this way, of three strongest pilot waves' of the member's of an active set's each is checked peculiar. Extension of this operation gestalt adds three additional bits to the strongest pilot wave of the 4th and the 5th **** [6th] from the member of an active set, and checks these peculiar. Moreover, the further operation gestalt adds an additional bit to a message, and it shows the related reinforcement of the pilot wave of rather still finer quantum level rather than it only calls it a threshold deltar top or the bottom. Still more nearly another operation gestalt includes all Ec/Io values in each pilot wave. in this way, a system with a pilot wave with the six possibility of an active set — receiving — an active set — each — Ec/Io is included in a possible pilot wave. It is clear that send [the related Ec/Io value which is proportional to the greatest pilot wave about Ec/Io of the greatest pilot wave of an active set at delivery and a degree] it is another possible operation gestalt. Although each of the operation gestalt of drawing 7 A - drawing 7 C specifies the option which reports the related measurement power in the foundation for every frame preferably, of course, it is also possible to combine an option. for example, the first two strongest pilot waves of a member base station can be checked using the first 6 bits of the measured power message, and the following three strongest pilot waves' relative position can also be checked about five members' set namely, — using the following three bits.
[0067]
Another another approach has an independent base station for transmitting to a mobile station. In this case, it is necessary to transmit only three bit vector messages (namely, I1-3) to a base station from a mobile station. In another arrangement, it must have the multiplex subcarrier base station transmitted via one antenna at once. In this case, which antenna an independent bit uses and to specify are required. Needless to say, a bit can be used combining the approach to which it is explained above.
[0068]
When communicating on the well-known first or a late fading channel, in order to conquer the

bad influence of fading more effectively, another operation gestalt for determining deltar threshold is used. Objectively [the desirable operation gestalt on the basis of the average pilot wave to whom deltar has the largest S/N ratio on a frame], in this operation gestalt, the minimum value of the maximum pilot wave on a frame is used in order to determine threshold deltaR. Therefore, even if the even if strongest pilot wave receives fading, he can act as more pilot waves more than deltar threshold by setting threshold deltar as the minimum of the strongest pilot wave on a frame. Therefore, a signal can be combined more from many base stations, therefore a lot of diversity gain can be attained [add / at least / independence or / much / half-independent pass] more. More specifically in the first fading environment, the fading period should usually operate [the use explained to the above of the minimum value to the strongest pilot wave on a frame] appropriately to the scenario of comparatively short first fading to the die length of a frame.

[0069]

However, the interleaver used in a receiving process does not bring about profits for the more usual case, and a lake receiver and the mobile engine performance do not have the forge-fire engine performance mainly large when the period of fading is shorter than the period of an interleave in a first fading environment to late fading. However, in order to give the quality of the communication link which can admit mobile **, bigger Eb/No. is required of late fading when the period of fading is longer than the span of an interleaver. Furthermore, the period of one frame for equalizing a related pilot wave's reinforcement is not enough to determine whether have received fading with a late related communication channel.

[0070]

Therefore, in an operation gestalt, each of a related base station carries out the filter which unifies and normalizes each of Uk bit in a bit vector message (refer to drawing 7 A and 7B). Each of Uk bit toggles (it changes to two conditions), namely, when changing a condition once [at least], the channel from which the base station and mobile station with which this toggle is related have received late fading shows that late fading is received. Therefore, the system performance of a CDMA system improves, when the base station which has received late fading is continuing transmitting on a forward traffic channel. It can be used as an indicator of a system control station to show whether in the toggle action observed, a mobile station should be put on a software hand off field again. For example, when the bit field which shows the pilot reinforcement to the given base station is always about 0 or is always 0, since this office does not apply a profits value at all as a matter of fact to the engine performance of a mobile station, the base station which had to show that a related base station had a more sharply [than a pilot wave with strong ******] weak pilot wave, and has made the weaker pilot wave must not be included in an active set. Moreover, only when a mobile station supervises toggle actuation effectively and this office wishes to change the base station transmitted to the mobile station, it cannot be overemphasized that a message can be transmitted to a base station.

[0071]

With another operation gestalt, it can change to signal transmission and a process can be performed more quickly. In this case, a mobile station transmits between fading, when a base station becomes stronger than one piece or the signal from other base stations beyond it or becomes weak, and it transmits a signal to a base station directly. A base station answers without [without it transmits, or] transmitting the following frame. In this case, since the 1st frame can be made to be able to transmit from one base station and the frame following a degree can be made to transmit from the base station of another side, a base station can answer more quickly than the control unit of a base station, and can make a change rapid. This operation is comparatively useful at the fading rate like inside. Even if signal transmission and a change are rapid, they can make a change cause between frames. In one operation gestalt, a base station encodes and interleaves the data for transmission, and processes them further. Un-operating-izing [flow of the output of data is actuation-ized based on the feedback from a mobile station, or].

[0072]

As an alternative plan of the threshold method for determining which pilot wave in a pilot quality

bit vector is specified, the 2nd "finger allocation" is explained in this specification. In being mobile, a mobile station estimates pilot Ec/Io received from the base station in all active sets. it is mobile -- when it does not have the finger of the diversity receiver of equipment, Ec/Io to a pilot wave is set as 0. When it has the finger of the diversity receiver with which the mobile station was assigned to the given base station, a numeric value is reported after determining average (or it is more long or it is desirable that short averaging time can be used) Ec/Io over 20 mses of mobile ** and a front. The period of 20 mses corresponds to CDMA frame length. A mobile station specifies the greatest Ec/Io value and the greatest pilot wave who has the assigned index Am. To all other pilot waves in an active set, a mobile station sets the bit value to which it relates in a bit vector message as 1, when the Ec/Io value to a pilot wave is deltar within the limits of the Ec/Io value to the greatest pilot wave. More than N pilot wave is not reported into a bit vector message that N is six or less when a receiver has only N finger.

[0073]

Since a finger can be assigned to the both sides of direct signal pass and image pass (namely, multi-pass image), it prevents that the finger allocation approach receives a report as that in which "too many" base stations have a mobile more usable signal. For example, when the diversity receiver has three fingers and only two base stations have made the signal of the three highest quality (namely, direct pass from each base station and an image signal), since the receiver does not have sufficient finger for receiving a signal, it does not need the 3rd base station for transmitting mobile. On the other hand, since there is an example of a large number referred to as that a diversity receiver compounds the signal from the 3rd base station when the pilot wave from the 3rd base station exceeds one of the three signals of other periodically, it may carry out in case of more than the threshold that he mobile-**, nevertheless wishes, and may report to all three stations. Therefore, the pilot SN ratio to a base station is reported in one operation gestalt of this invention by the highest SN ratio from a base station based on a finger.

[0074]

Drawing 8 is a flow chart which shows the desirable approach, in order to adjust forward channel power allocation. a process is mobile -- it is started at step S1 which measures the pilot reinforcement (signal quality) of all the pilot waves of a mobile active set within the limits. A process progresses to step S3 which generates threshold signal deltar based on the pilot reinforcement measured in step S1 here. Signal deltar is generated based on the pilot wave who has the greatest SN ratio as measured in step S1. The pilot wave and pilot wave i of a process who are related here are larger than deltar, or it progresses to the step S5 equal to it. If it can do, as for a comparison step, it is desirable that they are performed over the frame period of 20 mses, and are completed by the end of a frame period although other sample sampling intervals taken up in respect of the others within the limits of a frame or in multi-framing are in agreement with this operation gestalt. The related pilot wave i is larger than deltar, or when equal to it, the bit in the bit vector message which shows the related pilot wave i (for example, refer to drawing 7 A-7C) has him. [larger than threshold deltar] However, it is set up so that it may be shown that a pilot wave i is not larger than deltar in step S5, or the related pilot wave i of the bit in a bit vector message is smaller than deltar, or it is equal to it when being equal to it is determined (if it can do, it is desirable to set a bit as "0").

[0075]

the process of a bit vector is mobile after a pilot quality bit vector is formed in step S7 or step S9 -- it progresses to step S11 which transmits a bit vector message to the base station in a mobile active set. at this time, it is mobile based on the mobile anticipation of a system control station 10 which adjusts the power in a forward traffic channel corresponding to an early mobile ** and mobile bit vector message -- the timing loop mobile [as an indicator for / which determines when a finger is adjusted / being mobile] and used is set up. By setting up a timing loop (it being able to attain mobile more easily by calculating the frame of continuous 20 mses), it knows when it was changeful in mobile ** and forward traffic channel transmission. A process progresses to S13 which a base station relays to a system control station after receiving a pilot quality bit vector after step S11. since the selector in the place of a system control station carries out bit vector message processing of the process after step S13 -- which base station

under mobile set under actuation -- a mobile active set progresses to step 15 which generates the control message transmitted to each of the related base station which controls whether a related code channel must be transmitted mobile. The total power emitted from the base station in a mobile active set by controlling transmission from each of the base station in a mobile active set is reduced.

[0076]

A process progresses to step S17 which adjusts mobile ** and a finger in the base station which was equal to signal deltar as determined in step S7 and S9, or was pinpointed as a larger thing, and a corresponding diversity receiver, after a timer reaches a time amount threshold. The energy with which it was received only from base stations in the mobile active set which is carrying out fact transmission on the code channel which mobile-** and is related by adjusting a finger, such as this, is compounded. after step S17, a process is mobile -- it repeats supervising succeedingly the related pilot reinforcement to each base station in a mobile active set.

[0077]

Since a mobile station generates a specific bit vector message and the response to the bit vector message of each base station is due to the algorithm set up beforehand again, the time amount by which each base station changes forward link allocation is known by the mobile station. Therefore, a mobile station can combine correctly the signal only from the base station then transmitted. Since combining the signal from the base station which has not been transmitted to a specific mobile station may cause an unnecessary noise introduced into the receiving process which has a bad influence on a result, this function is an advantage. There is a possibility of producing engine-performance loss and the higher loss of Eb/No and capacity needed as a result, about an operation of a noise. Similarly, a mobile station is transmitted to a mobile station, and when the signal received from the big value is not compounded, there is a possibility of becoming loss of capacity.

[0078]

In one operation gestalt of this invention, a message is received correctly and a mobile station amends the error for the transmission to which it is in charge of reception of the bit vector received by each base station by the attempt of the beginning for restoring to the forward frame received as what was processed by the base station. In most cases, a mobile station restores to a frame correctly, but when the frame serves as an error, a mobile station may try to use the set of the base station transmitted to the mobile station, before a base station transmits the latest bit vector message. Therefore, when a base station does not receive the newest bit vector message, while a mobile station uses the set of the base station used before, there is a possibility of trying to restore to a frame again. For this operation, a mobile station needs to maintain the signal received from the various sets of the base station in a buffer. Then, when a mobile station has an error, the data in a buffer will be used for it. Error correction processing is illustrated as it is shown by the broken line to step 19 and is in steps S19 and S21 as an option of drawing 8 .

[0079]

Drawing 9 is the flow chart of the option for changing the forward traffic channel power allocation for the base station in a mobile active set. a process is mobile -- it is step S32 which measures the pilot reinforcement to which each base station in a mobile active set relates, and is started. Next, threshold signal deltai based on the mobile ** and pilot reinforcement who were measured is generated in step S34. And after comparing the both sides of a multi-pass signal with it being direct (direct 1), a multi-pass signal compares direct, a multi-pass, or both sides, in order [which receives each of the base station which mobile-** and is related in step S36] to decide [direct or] whether it is larger than deltar or equal to it. A multi-pass image is larger than deltar, or when equal to it, as for a process, the diversity receiver progresses a finger (plurality is included) to direct [larger] or larger step S38 assigned to a multi-pass signal or its both sides than deltar direct or as it was determined in step S36. next, any of the direct or the multi-pass signal of a base station which are related in step S36 although a process progresses to step S42 -- although -- or it is not larger than deltar -- case it is not equal -- a process -- the finger of a lake receiver, and a synthetic vessel circuit -- it progresses to step S40 by which

neither is assigned to the specific base station. A process progresses to step S42 there. deltar in drawing 9 must care about differing from delta in drawing 7. Although used for determining whether deltar reports a pilot wave in drawing 8 , delta is used for determining whether assign the finger of a lake demodulator in drawing 9 . Similarly, generally deltar in drawing 9 is smaller than delta of drawing 7.

[0080]

In step S42, the bit vector message which shows the finger allocation made from mobile ** and a place direct mobile on a multi-pass signal is transmitted to a base station and an active set. either direct or a multi-pass signal -- although -- when larger than deltar, a multi-pass image formats the mobile ** and bit vector message which shows that it is larger than deltar or direct at least or equal to it. A process progresses to step S44 which relays a bit vector message to the selector in the place of the control unit of a system, in order to enable it to adjust the forward traffic power allocation which a system control station is told about the finger allocation used in the mobile place from it, therefore which base station to each of the base station in a mobile active set transmits to a mobile station. A process progresses to step S46 which a selector transmits to the base station in the mobile active set in which it is shown which base station should transmit a control message on the related code channel corresponding to the finger allocation set up more mobile from it. A base station relays a control message mobile so that a mobile station may receive the notice of a purport whose base station received the notice about allocation of the system control station of forward traffic channel power. a process -- and it is mobile -- it progresses to step S48 which adjusts the finger in a diversity receiver corresponding to the control message generated by the system control station.

[0081]

It must care about [a base station or] whether it is an error any of the control message transmitted to the mobile station from the base station they are from a mobile station. The same technique as what was explained in relation to drawing 7 can be used. In this case, when a mobile station does not receive the control message from a base station, or when a mobile station receives a frame in an error, a mobile station can restore to the set of the base station before having transmitted to a mobile station.

[0082]

the inside of the approach for changing another forward traffic channel power allocation -- S15 from step S1 ****** -- a base station -- moreover -- mobile -- again -- which base station -- **** -- it has transmitted on the forward traffic channel to which this office relates -- although it carries out transmitting that display, it is the same as what is shown in the desirable approach of drawing 8 . Therefore, it is not mobile in another operation gestalt, and controls which base station transmits a system control station mobile.

[0083]

This inventions have been explained by the semantics which sets up threshold deltar relevant to a pilot wave with the strongest reinforcement as they were explained to be a text and drawing 5 in 6. Much another metrics can be used. Only when a pilot wave makes sum total Ec/Io fully increase especially, what sets up '1' from a bit U1 can be used again. This technique is transferred to the grantee of this invention of the application number 08/No. 790,497 entitled "the approach and equipment" for carrying out the software hand off in a radio communications system, and is explained in the concurrency application United States patent built into this specification by the citation.

[0084]

This invention is explained by the semantics which transmits the whole forward link from the set of a base station and a mobile station. The system and approach for carrying out fundamental high speed datalink which uses an auxiliary channel again The inside of the concurrency United States patent application number 08/No. 798,949 of the title called "transmission power reduction for the high-speed CDMA link in a software hand off" by which both sides are transferred to the grantee of this invention, and are incorporated in this specification by the citation, Moreover, it is explained in the concurrency application United States patent application number 08/No. 784,281 of the title called "high-speed-data velocity aid channel for CDMA

communication system." The forward link is divided into the base and the auxiliary channel in the high speed datalink system. A basic channel is continuously transmitted from a base station in an active set. An auxiliary channel is transmitted from the same base station as a subset of a basic channel or a channel. This invention currently explained in this specification is applicable to a basic channel, an auxiliary channel, or its both sides.

[0085]

Drawing 10 is the spectrum Fig. of a multiplex subcarrier diffuse-spectrum forward link and an independent subcarrier broadband diffuse-spectrum link. Although not completely shown by scale, the diffusion region bandwidth to each subcarrier is shown as 1.25MHz to the measure of a multiplex subcarrier, and a diffusion region bandwidth is 3.6864MHz to the measure of the broadband of an independent subcarrier. The measure for a multiplex subcarrier has various advantages including being able to transmit each subcarrier from the antenna of a different configuration, offering a characteristic fading pattern to each subcarrier so that fading of another side and all three subcarriers may be reduced to coincidence, therefore intercepting a communication link.

[0086]

Drawing 11 is the block diagram of the multiplex subcarrier transmitting system formed according to one of the operation gestalten of this invention. The notation which the input data was encoded by the **** condition, and was punched and encoded with the conventional convolution encoder 100 is repeated with the notation iteration vessel 102, and is added to additional redundancy. The notation which the Brock interleaver 104 was arranged by turns at intervals of the time amount of 20 mses in the repeated sign, and was arranged by turns is scrambled via XOR gate 106 in decimal-number-system-ized long code which was generated by the long code generator 108 and long DESHIMETA 110 corresponding to a user's long code mask. The scrambled notation is divided into the flow of the notation transmitted on the carrier signal respectively related with a demux 112.

[0087]

The map of the flow of a related notation is carried out to QPSK by the QPSK mapper to each carrier signal. A QPSK notation is respectively modulated with the same Walsh code modulator 116, and the Walsh chips made as a result are the inphase diffusion code PNi and 4 phase diffusion code PNQ further, and are modulated by dispersion equipment 118. If it can do, as for PNI and PNQ, it is desirable that it is the same to each subcarrier. As for the diffusion notation produced as a result, being transmitted is desirable after being converted with the equipment (up converter) with which each raises a frequency to a peculiar frequency there, if it can do. Although drawing 11 shows the modulation by the same Walsh channel code to each subcarrier, the Walsh channel codes may differ.

[0088]

Drawing 12 is some block diagrams of the receiving system for processing the multiplexer-channel signal when being constituted according to one operation gestalt of this invention used more mobile. The energy of the radio frequency to which the frequency was lowered with the down converter is filtered by 5MHz with a band-pass filter 200, and a sample extract is carried out by A/D202 at the rate of 8X1.2288. In a filter bank 204, the frequency of the sample of two 1.25MHz parts is a digital method further, and it is based on the 1.2MHz oscillator (NCO) by which numerical control was carried out, or is lowered to baseband by 1.25MHzNCO(s) and 2.5MHzNCO(s) as an option, and the set of three samples is filtered by 1.25 **** with a low-pass filter. This low-pass filter can be used as the part of the filter adjusted by the receiver or a filter. The data filtered with the low-pass filter produced as a result are passed to the lake receiver 210, and a receiver is compounded after restoring to the example of the various multi-passes of the transmitted signal. After being sent to deinterleaver and decomposed from a mutual array, the double sign of the compounded soft decision data which were produced as a result is carried out.

[0089]

Needless to say, much reconstruction and deformation of this invention are possible in the light of the aforementioned explanation. Therefore, this invention shall be interpreted as what can be

carried out even except that it is concretely explained in this specification within the limits of the claim of separate attachment.
[Brief Description of the Drawings]
When thinking in relation to the drawing of separate attachment, he can acquire the advantage which a majority of perfect understanding of this invention and this inventions accompany by quoting the following detailed explanation, and can understand it well again.
[Drawing 1]
Drawing 1 is the block diagram of the CDMA cellular telephone system as an example according to this invention.
[Drawing 2]
Drawing 2 is the field of the software hand off on the graph of the quality pair time amount of a pilot channel, and this graph.
[Drawing 3]
Drawing 3 is a mobile block diagram.
[Drawing 4]
Drawing 4 is a graph which shows the example of the probability of framing error **** Eb/No to the various figures of the base station transmitted as received by N finger diver city receiver.
[Drawing 5]
Drawing 5 is a graph which shows the Ec/Io pair time amount of the software hand off field to three pilot waves as an example within the limits.
[Drawing 6]
Drawing 6 is the same graph as what was shown in drawing 7 A with the addition of threshold signal deltar formed below on the highest pilot level.
[Drawing 7 A]
Drawing 7 A is drawing of the 1st DS to the bit vector message which shows the quality of a channel.
[Drawing 7 B]
Drawing 7 B is drawing of the 2nd DS to the bit vector message which shows the quality of a channel.
[Drawing 7 C]
Drawing 7 C is drawing of the 3rd DS which receives the bit vector message which shows the quality of a channel.
[Drawing 8]
Drawing 8 is the flow Fig. of the sequence of the message for reducing the amount of the whole forward traffic channel power transmitted from the base station in an active set when excessive power is transmitted.
[Drawing 9]
Drawing 9 is the flow Fig. of the sequence of another message for reducing the amount of the whole forward traffic channel power transmitted from the base station in an active set when excessive power is transmitted.
[Drawing 10]
Drawing 10 is drawing of a multiplex subcarrier forward link.
[Drawing 11]
Drawing 11 is the block diagram of the transmitter of a multiplex subcarrier forward link.
[Drawing 12]
Drawing 12 is the block diagram of a multiplex subcarrier forward link receiver.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to cellular communication system, the modification approach of forward traffic channel power allocation [in / more specifically / code division multiple access (CDMA) cellular communication system], and equipment.
[0002]

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PRIOR ART

[Description of the Prior Art]
Since the common cycle numerical range band is generally mobile, in order that it may be used for the communication link to the set of a base station and may communicate from a base station to MOBAIRU in CDMA cellular communication system, generally other common cycle numerical range bands are used. In other examples, in order to communicate, the set of a common cycle numerical range band can be used. The main profits which transmit multiplex communication on a common cycle numerical range band are the increments in the capacity of a cellular telephone system. LS-95 specification specified by Telecommunications Industry Association (TIA) is the example of the air interface of CDMA of the high performance used in order to carry out a cellular telephone system.
[0003]
The set of the communication link carried out on the cycle numerical range band same in CDMA cellular communication system is distinguished after dissociating mutually by getting over after modulating the data transmitted for the both sides of reception and a transmitting system using the false random-noise (PN) code which is known. Other communication links appear as a background noise during processing of all specific communication links. Since other communication links appear as a background noise, in order that they may use an available cycle numerical range band more efficiently [a CDMA protocol like IS-95], extensive transmitted power control is often used. Transmitted power control holds down communicative transmitted power to the minimum, in order to communicate exactly. Transmitted power control makes processing of a communication link of all specification easy by lowering the level of the background noise generated by other communication links.
[0004]
it is being able to use for also obtaining ** which makes it transmit to a base station with the 2nd cycle numerical range band since mobile [make transmit to MOBAIRU on the same cycle numerical range band from base station transmission and], and one profits making MOBAIRU transfer to the coverage area of the 2nd base station from the coverage area of the 1st base station using a "software hand off." A software hand off is a process which makes MOBAIRU coincidence interface with two pieces or the base station beyond it. A software hand off can be made to contrast with a hard hand off while an interface with the 1st base station is closed before an interface with the 2nd base station is established.
[0005]
Although it is obvious **, since connection of a piece is always maintained at least, generally the software hand off is stronger than a hard hand off. The approach and system for carrying out the software hand off in a CDMA cellular telephone system Both sides are transferred to the grantee of this invention, and are incorporated by citation in this invention by the citation. U.S. Pat. No. 5,101,501 for which it applied on November 7, 1989 entitled "the approach and system" for offering the software hand off in a CDMA cellular telephone system, and a communication link, It is indicated in U.S. Pat. No. 5,267,261 entitled "the mobile station supported by the software hand off in CDMA cellular communication system."
[0006]

After each base station obtains early system synchronization according to the software hand off procedure currently explained in the patent quoted above, in order to offer the powerful time amount of a signal, frequency, and phase trace which were transmitted to the cellular site, the related pilot channel used more mobile is transmitted. Although a common diffusion code (namely, false noise sequence) is used for the pilot channel transmitted by each base station, different code phase offset is used for it, and it enables it to distinguish the pilot channel transmitted from the base station where a mobile station is related.
[0007]
Two pieces or the base station beyond it transmits the same forward link data mobile between software hand offs. A signal is compounded after receiving the signal from the set of mobile ** and a base station. The approach and the equipment for compounding are transferred to the grantee of this invention, are entitled "the diver city receiver in a CDMA cellular telephone system" incorporated in this specification by the citation, are explained into the United States patent number No. 5,109,390 for which it applied on November 7, 1989, and are indicating the diver city composition approach for use in a CDMA cellular telephone system.
[0008]
While a software hand off offers more powerful connection, in some examples, a software hand off does a bad influence to the capacity of the whole CDMA cellular telephone system again. It is because the transmitted power of the whole used for this carrying out the communication link to which the multiplex forward link transmission generated between software hand offs is equivalent is increased. The transmitted power which increased increases the background noise of the whole generated by the system, and decreases the capacity of the whole system on the other hand.
[0009]
It is influenced by the environment generally put between mobile ** software hand offs whether a software hand off increases the capacity of a system or it is made to decrease. it is mobile -- when put to the environment of fading, since a signal generally decreases the diversity which was brought about by the software hand off and which increased according to an individual, generally it is advantageous to the engine performance of a system. it is mobile -- when it is in a non-fading environment, generally the diver city of a data source is redundancy-like. Therefore, as for the profits brought about to the non-fading environment by the diver city to which the signal source increased, a software hand off does not have phase murder of increase of the whole transmitted power of a cause.
[0010]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
Therefore, the place which this invention means is improving the engine performance of CDMA communication system by optimizing the gestalt of the CDMA communication system between the software hand offs in the both sides which answer the environment the communication link in a multiplex subcarrier environment being carried out.
[0011]
Therefore, one of the purposes of this invention is offering the new approach for reducing the amount of the whole forward traffic channel power which receives mobile between software hand offs. Another purpose of this invention is offering the system which performs the aforementioned approach. another purpose of this invention is mobile -- it is determining the environment which operates between software hand offs, and optimizing the gestalt of a software hand off corresponding to this decision. This invention is applied to a multiplex subcarrier forward link again. Therefore, one of the purposes of this invention is offering the new approach for reducing the amount of the whole forward traffic channel power transmitted mobile by the multiplex subcarrier forward link. Another purpose of this invention is offering the system which enforces the aforementioned approach. Another purpose of this invention is determining the environment which is carrying out mobile ****** and optimizing the gestalt of a multiplex subcarrier forward link corresponding to this decision.
[0012]
This invention is applied to the system which uses the both sides of a software hand off and a multiplex subcarrier forward link.
[0013]

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MEANS

[Means for Solving the Problem]
this invention is mobile -- an approach and a system with the freshness transmitted to the system control station in which the pilot wave from each base station in the "active set" of the pilot channel which was able to catch the bit vector message more mobile is quantified frequently, and the quality (for example, signal pair interference ratio) of the measured signal is shown are offered. After generating a bit vector message under supervising the quality of the signal with which mobile ** and a pilot wave are related and transmitting the quality of a related pilot channel to the base station where it is related in the active set of migration of a bit vector message as compared with a criterion, the information in a bit vector message is sent to the control unit of a system. Corresponding to this, the control device of a system emits a command to the base station in a mobile active set, and adjusts one as which the code channel power with which a base station is related was chosen according to the quality of a related pilot channel reported in the bit vector message generated more mobile.
[0014]
Since a forward traffic channel consists of the code channel to which the base station in a mobile active set relates, reduction of the transmitted power of a related code channel reduces the power with which the forward traffic channel was transmitted. Therefore, the capacity of the whole CDMA communication system increases as a result of the minimum radiation which forward traffic channel power required for right reception in a mobile place takes. By communicating the quality of the pilot channel observed quickly to the control unit of a system, a CDMA system re-optimizes the system source quickly corresponding to an environmental change, and can make channel capacity the maximum.
[0015]
In another operation gestalt of this invention which uses a multiplex subcarrier link, a mobile station transmits a bit to each subcarrier, or instead transmits a bit at all antennas. Furthermore, a base station adjusts power according to an individual on each subcarrier.
[0016]
[Embodiment of the Invention]
Although the communication system 2 which is a desirable cellular telephone system is shown in drawing 1 if the components with which a reference number is the same through two or more drawings with components, or corresponds about a drawing are shown and it says in more detail, it is equally [to public line exchange (PBX), a Personal Communication Service (PCS) system, a satellite communication system, an inside-of-a-house wireless network, or an outdoor wireless network] applicable. This system 2 uses a code division multiple access (CDMA) modulation and a recovery technique for the communication link between system resources. There are the interface and processing circuit where a system enables it to control 1 set of base poles 12, 14, 16, 17, and 19 in the system control station (selector) 10 generally called mobile phone switch office (MTSO). A system control station 10 controls routing of telebrief to the base stations 12, 14, 16, 17, and 19 which correspond from a public telephone switched network (PSTN), in order to transmit to the corresponding transmission place again. Are in PSTN or the connection from PSTN may be any of wireless, an optical fiber, or a "cable" (for example, twist paired-cable and

coaxial cable) communication link. A system control station 10 communicates with a data network, a multimedia network, the local area network that, in addition to this, contains premises and a public correspondence entity, and a public correspondence network. Furthermore, a system control station 10 communicates with other base stations which are not shown in drawing 1 .

[0017]

A system control station 10 communicates with base stations 12, 14, 16, 17, and 19 with various means, such as for example, a leased telephone circuit, a fiber link, a coaxial link, or a radio frequency (RF) communication link. Base stations 12, 14, and 16 communicate by the alien system and single subcarrier wireless CDMA communication mode which are called a mobile station ("mobile"). Base stations 17 and 19 communicate with an alien system called a mobile station 21 by the multiplex subcarrier link which consists of three CDMA signals shown by arrow-head 26 a**c. A mobile station 21 communicates with base stations 17 and 19 by the single subcarrier reverse link 28. It cares about that a multiplex subcarrier forward link may consist of four or more subcarriers or two subcarriers or less. Drawing 1 indicates the direct diffusion system of the single subcarrier used more commonly to be the multiplex subcarrier which lives together in the same system again. Although such coexistence is possible, it cares about using the desirable forward link of a monotype [system].

[0018]

Arrow heads 20a and 20b are illustrating the reverse link and forward link between a base station 12 and a mobile station 18, respectively. Arrow heads 22a and 22b are illustrating the reverse link and forward link between a base station 14 and a mobile station 18. Similarly, arrow heads 24a and 24b are illustrating the reverse link and forward link which are considered between a base station 16 and a mobile station 18. Although the direct continuation or radio frequency connection with a mobile station 18 from each base stations 12 and 14, the crosslink between 16, or a control unit 10 are not shown in drawing 1 , such possibility is also included in the mode of this invention.

[0019]

If it is ordered a system control station 10 establishing base stations 12, 14, and 16 to the active set of a mobile station, and establishing an interface with the mobile station 10 concerned to allocation and each base station, base stations 12, 14, and 16 will put traffic data on the communication link forward links 20b, 22b, and 24b using the Walsh code channel, and will transmit it to a mobile station 18, respectively. The code channel assigned to the communication link with a mobile station 10 is also called a traffic channel. Redundancy (duplication) information is included in each code channel sent to the mobile station from a different base station, and a mobile station 10 combines each code channel using a diversity (this specification explains in more detail) composition mechanism using this. Although the forward link rate to a mobile station is raised, the multiplex code channel from the same base station can be used. In this case, the set of a code channel is called a traffic channel. A forward link signal has the subset of a traffic channel, and the set of the code channel containing auxiliary control channels, such as for example, a pilot channel, a synchronous channel, and a paging channel. This invention reduces the transmitted power of a forward link signal between software hand offs by reducing the time amount to which the traffic channel is active.

[0020]

Base stations 12, 14, and 16 transmit a pilot channel to a mobile station 18 again through the forward communication links 20b, 22b, and 24b, respectively. A pilot channel is distinguished from the traffic channel transmitted in Walsh code from the same base station. Each pilot channel from a different base station is mutually distinguished by pilot PN code shift. When there is neither Brock nor fading, it is expected that it becomes a bigger power signal than a base station 12 and the received signal power of 14 since the pilot channel which a mobile station 18 receives from a base station 16 has a mobile station 18 and a base station 16 in the location approached most.

[0021]

Or instead of using the code channel (Walsh code) which became independent to the pilot wave,

it can embed at the traffic channel stream by which a pilot wave is seen off in each mobile station, or can multiplex. Embedding can be performed by using a special pilot symbol or an auxiliary signal. When using the embedded pilot wave, generally a pilot wave common to the first system prehension and the detection at the time of a hand off will be employed. Or it is each traffic channel unit, or another pilot wave can be transmitted per group of a traffic channel.
[0022]
When a mobile station 18 is in a software hand off field, a system control station 10 emits a hand off prompting message including the list of base stations to which the active set of a mobile station is assigned (for example, when moving to the coverage area of at least one another base station from the coverage area of at least one base station). The auxiliary information of the hand off threshold (for example, an addition threshold and a fall threshold) which is useful to a mobile station for example, after hand off operation is also included in the hand off prompting message again. The pilot wave from the base station used to establish an interface with a mobile station is contained in an active set as explained by the application and the IS-95 standard which were quoted previously. The pilot channel in which a mobile station has sufficient die length detected recently, and the pilot channel from the base station where it turns out that it is in the same geography field are contained in a candidate set.
[0023]
or [that which pilot channel tends to become appropriate strength] -- if it understands, required processing can be reduced with the mobile station of searching the near candidate set and active set of a mobile station frequently in quest of the pilot channel corresponding to a base station (namely, thing for which it knows which base station being assigned to the near candidate set of a mobile station).
[0024]
Drawing 2 is a graph observable from a mobile station 18 which shows the relative pilot channel quality from cels 12, 14, and 16 as it is shown in drawing 1 . the graph of drawing 2 -- the time amount of three instantiation pilot channels from base stations 12, 14, and 16 -- receiving -- the total received power in a mobile station 18 -- (-- energy (Ec) is plotted per PN chip of per Io). It is alike, therefore a signal quality deteriorates, and the pilot wave from a base station 16 shows the thing in which time amount passes and which the mobile station 18 is keeping away from the base station 16 as shown in drawing 2 . On the contrary, the signal quality of the pilot wave from a base station 12 improved with time amount progress, and it has suggested that the mobile station 18 is moving toward a base station 12. While the signal quality of the pilot wave from a base station 14 had been comparatively fixed, it is shown that the mobile station 18 is moving along the circumference of a base station 14.
[0025]
The area which poses a problem by drawing 2 is a software hand off field. In a software hand off field, it judges which base station a mobile station 18 and a system control station 10 have in the active set of a mobile station by communicating mutually based on the relative quality of the pilot channel of cels 12, 14, and 16. In the example of an illustration, since the level of the pilot channel from a base station 16 was over the addition threshold, the pilot channel exists in the active set of a mobile station at the beginning. However, at the edge of a software hand off field, over a certain time amount, the pilot wave from a base station 16 is less than a fall threshold level, and falls.
[0026]
In a response, a base station 16 is removed from an active set with a system control station 10 by the communication link to a system control station 10 from a mobile station using a pilot on-the-strength measured-value message. In order that the pilot wave from a base station 14 may never exceed an addition threshold level, a base station 14 is not added to an active set. By contrast, a base station 12 is added to an active set, when the pilot on-the-strength measured-value message which exceeds an addition threshold over required time amount, therefore a mobile station 18 generates is answered and it is judged by the system control station 10. Near the edge of a software hand off field, only the signal of a base station 12 remains in the active set of a mobile station 18.

[0027]
Even when the traffic channel to which the bad pilot channel of a receive state is equivalent has hardly affected the receiving quality in a mobile station, it is sometimes often detected that it is sufficient frequency to exceed a fall threshold and maintain a corresponding base station in an active set. In the case of a late fading environment, this is especially applied. In the case of a late fading environment, the signal level received from the base station changes mutually slowly. Generally, signal level is strong and this reverse is also realized for the time being than base station where one base station is another. A fading rate is not sufficient speed to acquire the short-term advantage of a diversity. Therefore, it is desirable to transmit from a strong base station from a weak base station.
[0028]
This invention is investigating shortening the air time of the code channel from some base stations in a fading environment in order to reduce the total transmitting energy generated about a related communication link. If the total transmitting energy of a specific communication link is reduced, a system-wide capacity can be raised. The hand off procedure which excepts a base station from an active set can be used for it, and it should care about that transmitted power may be able to be reduced by it. This makes it difficult to change with transmission quickly from the base station, when the signal from other base stations turns into a strong signal more.
[0029]
Another example is a mobile station, and although the signal from a certain base station was received with signal level lower than another base station, when having still exceeded the fall threshold, it is an example to which this invention is useful. It is desirable to transmit only from the base station where a signal is more strongly received with a mobile station in the environment which does not almost have fading. However, if hand off procedure is used in order that a base station may separate from an active set and may return that base station to an active set after that, remarkable delay will be brought about when this pilot wave becomes strong. This delay decreases the quality of a link and makes a message fall.
[0030]
Drawing 3 is the block diagram of a mobile station 18. The antenna 30 is compounded by the analog receiver 34 and the transmitted power amplifier 36 through the diplexer. A diplexer 32 enables it to perform simultaneous transmission and reception through an antenna 30 in cooperation with an antenna 30. An antenna 30 receives the pilot [who receives RF energy from each base stations 12, 14, and 16] channel signaling by whom routing is done through a diplexer 32 on the other hand (drawing 1) to the analog receiver 34, and code channel signaling. The analog receiver 34 receives RF energy from a diplexer 32, and performs the open loop power control function which adjusts the transmitted power of a mobile station for transmission in a reverse link (from a mobile station to namely, a base station). A receiver 34 generates an analog power control signal, and this is sent to the transmitted power control circuit 38 as it is discussed by U.S. Pat. No. 5,056,109 which is included in this specification by indicating by reference here where it was transferred to the grantee of this invention and which was entitled "the approach and equipment" of transmitted power control with a CDMA cellular mobile phone system, if it says in more detail. It is transmitted by the forward link and a control processor 46 starts closed-loop power control adjustment using the reverse link power control bit stream to which it restores with digital data receivers 40, 42, and 45. The analog receiver 34 changes received RF energy into baseband signaling, and digitizes baseband signaling.
[0031]
The digital data receivers 40, 42, and 45 with which the output digitized from the analog receiver 34 operates according to control of search receiver 44 HE ****** and a control processor 46 receive the code channel from each base station, and each output is sent to a diversity composition machine / decoder 48. A diversity composition machine / decoder 48 compounds each output signal from receivers 40, 42, and 45 later based on the synthetic selected scheme discussed in a detail.
[0032]
Although three digital data receivers 40, 42, and 45 are shown in drawing 3 , generally the

diversity composition machine / decoder 48 is formed for the interface with some additional digital data receivers. Preferably, as for the number of the digital data receivers contained in a mobile station 18, it is desirable that it is equal to the maximum number (the independent direct signal and independent multi-pass signal which are generated from each code channel are taken into consideration) of the code channel which a mobile station adopts by the synthetic scheme. By including an additional data receiver, additional diversity gain is possible and this invention can be applied to the digital data receiver (or signal multi-channel digital data receiver) of the number of arbitration as it will discuss from now on.

[0033]

Digital data receivers 40, 42, and 45 form "lake" receiving structure in cooperation with a diversity composition machine / decoder 48. A diversity composition machine / decoder 48 cooperates with the receivers 40, 42, and 45 which play the role of three fingers in a lake, respectively. If it says in more detail, receivers 40, 42, and 45 can be set up with a control processor 46 so that the multi-pass signal from the code channel or the common base station from a different base station can be received. It can use for this receiving the code channel from three base stations which are different altogether in three sets of receivers 40, 42, and 45, or one code channel (namely, three multi-pass signals) from one base station at which it arrives via three different signal pass. It is clear that the combination of the arbitration of the multi-pass from a different base station and a code channel is receivable using receivers 40, 42, and 45. For example, based on the combination of some single channel receivers, a multi-channel receiver (that is, it has at least one channel), and a diversity composition machine, much other configurations can carry out lake receiver structure. Furthermore, the function of a diversity composition machine is incorporable into one of a control processor 46 or the receivers 40, 42, and 45.

[0034]

With a desirable operation gestalt, the output of a diversity composition machine / decoder circuit 48 is sent to DEINTARIBA and a decoder. Generally the output of a decoder passes the control unit which divides a receiving data stream into end user data and control data. End user data are offered to a data device like a voice coder.

[0035]

The data output of a data device, for example, a voice message identification code, is transmitted to the base station in a mobile station active set through a reverse link. It is baseband signaling, and the output of the user digital baseband circuit 50 is formatted, decrypted and interleave-ized, it is sent to the transmitting modulator 52 and modulated. The output of the transmitting modulator 52 passes the transmitted power control device 38 under control of a control processor 46. The transmitted power control circuit 38 adjusts the output power of a mobile station 18 based on the power level signal which the analog receiver 34 and a closed-loop power control bit offer, an output RF signal amplifies this output signal, it passes along the diplexer 32 HE **** transmitted power amplifier 38, and the amplified output signal is transmitted from an antenna 30.

[0036]

The code channel signaling and the pilot wave who transmitted with other CDMA signals which the base station in a pilot wave's active set commits as interference to a mobile station 18 are contained in the IF signal digitized from the analog receiver 34. The function of receivers 40, 42, and 45 is taking correlation with suitable PN sequence and IF sample. This correlation process offers the "processing gain" which raises the signal pair interference ratio turned to a mobile station by having consistency with PN sequence used to encode the message sent to a mobile station by each code channel. The signal which is not encoded using PN sequence to match and whose intention it does not have "is diffused" according to a correlation process, and the signal pair interference ratio of the signal whose intention it does not have falls. This correlation output uses a pilot subcarrier as subcarrier phase criteria, and is detected coherent. The result of this detection process is the data symbol by which a single string was encoded.

[0037]

The search receiver 44 under control of a control processor 46 scans the pilot channel and

multi-pass pilot channel which were received through direct pass and reflective pass (for example, multi-pass) from the base station. Receiving pilot energy (Ec) is used for the scanner receiver 44 per [to the total receiving spectral density, noise, and signal which are indicated to be Ec/Io as a receiving pilot wave's quality] chip. A receiver 44 provides a control processor 46 with the signal strength measured-value signal which shows each pilot channels and those strength.

[0038]

The timing of the input signal by which an alignment input is carried out is adjusted, and a diversity composition machine / decoder circuit 48 aligns it, and adds them collectively. The multiplication of the weighting factor which ****s in the relative signal strength of the pilot channel corresponding to each input before this addition can be carried out to each input signal. Since it is presumed that each pilot wave's signal quality is equivalent to the quality of the signal transmitted by the code channel of each base station, a weighting factor is based on pilot reinforcement. When using a weighting factor, a synthetic vessel performs the diversity composition scheme of the most effective ratio. Next, the composite signal stream obtained as a result is decrypted using the forward stream error detection decoder contained in the diversity composition machine / decoder circuit 48. The weighting approach of the pilot base often works, when the base station in an active set transmits code channel signaling to a mobile station at a rate equal to a pilot signal. That is, the ratio of the code channel power to pilot power is the same with all the members of an active set. When this ratio is not the same, other weighting approaches may be desirable. For example, a base station can transmit the ratio of a traffic channel [as opposed to pilot channel power in all the base stations in an active set] to a mobile station with the means of a signaling message or others. If the relative fraction to a base station j is alphaj, a mobile station can compound a code channel using weight root (alphajgammaj). gammaj is the relative received power in a receiving-base station j pilot wave's mobile station here. As an option, a mobile station can presume alphaj or alphajgammaj from the input signal from a base station j.

In addition to this, there is a baseband processing facility in the baseband circuit 50 with a voice coder (vocoder) data interface. Furthermore, the user digital baseband circuit 50 interfaces with I/O circuits, such as an earphone which inputs a sound signal into a digitizer and the vocoder (voice coder) contained there. The output of the user digital baseband circuit 50 is offered to the transmitting modulator 52, a coded signal is modulated to PN carrier signal, and PN sequence corresponds to the address function assigned about the message to leave. By the control processor 46, a base station (12, 14, or 16) transmits, and this PN sequence is defined from the message setup information which a receiver (40, 42, or 45) decrypts.

The output of the transmitting modulator 52 is sent to the transmitted power control circuit 38, and signal transmitted power is controlled by the analog power control signal offered from a receiver 34 there. Furthermore, a control bit is transmitted by the base station in the form of a power adjustment command, and the transmitted power control circuit 38 answers it. The transmitted power control circuit 38 sends the signal become [power control] irregular to the power amplification circuit 36. The power amplification circuit 36 amplifies the modulated signal, and changes it into RF frequency. The amplifier which amplifies the power of the modulated signal to final output level is contained in the transmitted power amplifier 36. The amplified output signal is sent to the diplexer 34 to base stations 12, 14, and 16 which compounds a signal to an antenna 30 for transmission after that. Base stations 12, 14, and 16 receive the signal for a system control station, and it is sent to the system control station 10 with which these signals are compounded, respectively.

[0039]

Drawing 4 is the graph of the diversity receiver engine performance measured as a probability of a framing error rate over Eb/No in case a diversity receiver performs rate composition of optimum ratio. Four instantiation-curves which show the probability of a framing error rate are shown about the migration receiver constituted so that a finger might receive the signal corresponding to three (M= 3) in 2 (M= 2) and a finger from the base station of the number corresponding to [finger / 1 (M= 1) and] the number of each four fingers (M= 4) in a finger. If

the curve of M= 1 is compared with the curve of M= 2, it has two fingers and the engine performance of the receiver which processes the pass of two is superior to the engine performance of the receiver which processes the pass of one. This comparison is performed by investigating the distance between each framing error probability curve about the given framing error rate (namely, broken line). An improvement of the engine performance is shown by distance M1-2 in a typical graph. Similarly, when a mobile station uses the diversity receiver of three fingers, the engine-performance improvement of M2-3 is attained. In that case, generally M2-3 are smaller than the engine-performance improvement of M1-2. If 4 Motome's finger is similarly added to a diversity receiver, an engine-performance improvement as shown by M3-4 will be attained. M3-4 should care about that it is smaller than M2-3 and M1-2. Thus, when a mobile station is a mobile station only in a CDMA system, the diversity receiver which has the finger of many numbers increasingly and receives the transmission from the base station of the number corresponding to the number of fingers will make an engine-performance improvement continuously, even if M becomes a large number and an improvement becomes only small. Furthermore, it is assumed that no finger contributes the relation about said engine performance only to the noise to a synthetic process. It depends for the absolute magnitude of an improvement on communication link conditions (for example, the amount of fading, the class of fading, impulsive force of a noise, contiguity to a base station, etc.).

[0040]

Among a software hand off, by utilizing a diversity composition process for a forward link and a reverse link, system capacity differs and is influenced. For example, by the reverse link, a mobile station is respectively transmitted to base stations 12, 14, and 16 through Pass 20a, 22a, and 24a (drawing 1). Each of a base station compounds each signal with which this was prepared in delivery and this by base stations 12, 14, and 16 to the system control station (selector) 10 using the diversity composition process in response to the transmission from a mobile station 18. Since only one mobile station 18 has transmitted, system capacity does not receive a bad influence by using diversity composition.

[0041]

However, a mobile station 18 makes a different signal (it has the encoded same information altogether) transmitted from base stations 12, 14, and 16 compound by the forward link. It is chosen for gain composition, such as the maximum ratio composition, and processing of one signal, and various synthetic approaches including simple selection by which other signals are canceled are learned for the industry. It is because transmission of the addition from the base station where it to which the overall system capacity of a CDMA system may be reduced in fact is communicating to the 1st mobile station appears as background interference to the 2nd mobile station although it is that preparing the base station of a number excessive probably of the addition to the active set of a mobile station raises the engine performance which surely is seen with the mobile station. It depends for the usefulness of a specific code channel on the various elements containing the reinforcement to the code channel from other base stations.

[0042]

If there is sufficient gain for a diversity, the sum total power emitted with CDMA communication system will become typical more small. However, as it accepted by this invention, even if it does not need the diversity of a metaphor addition, the total power emitted is typically large rather than it is needed for the appropriate engine performance. About whether the increase or reduction of electric energy emitted from each of a base station is influenced, it is dependent on the property of the transmitting way between a base station and a mobile station. According to 1 operation gestalt of this invention, the total transmitted power from a CDMA system is set as the much more optimal point of application by increasing correspondence with a mobile station 18 and a system control station (selector) 10. It describes below how the information to need is collected with a mobile station so that a system can operate by still higher capacity.

[0043]

Drawing 5 is the graph of the Ec/Io pair time amount of the software hand off area where three pilot waves A, B, and C from each base station are contained in the active set of a mobile station. between software hand off area, change of each communication channel of pilot waves A

(a dotted line shows), B (a broken line shows), and C (a continuous line shows) causes change of signal strength so that it may see from drawing 5 -- making -- and -- therefore, the ratio of a signal pair noise is changed and each pilot waves A, B, and C are fluctuated. These fluctuation gives big possibility of raising diversity gain, and it teaches how this invention raises diversity gain in order to make system capacity the maximum by changing power allocation of a forward traffic channel in a quick form.

[0044]

In relation to the signal of others any one of Signals A, B, and C, SNR changes so that pilot waves' A, B, and C relative pilot quality reinforcement (pilot quality) may change from a frame to a frame and may be seen from drawing 5 . For example, with the 1st frame, although a pilot wave A gives the greatest SNR, a pilot wave B gives the minimum SNR. However, with a frame 2, pilot waves' B and C correspondence signal-to-noise ratio carries out a crossover (it is shown in drawing 5 like) crossover, and a pilot wave's B SNR is larger than a pilot wave's C SNR at the edge of a frame 2.

[0045]

Although drawing 6 is the same as that of drawing 5 , deltar expresses the fixed level delta under the strongest S/N of the pilot waves B and C of the active set of a mobile station among drawing containing level deltar (a crossover "x" line shows) calculated by control PUROSSESSA 46 (drawing 3) of a mobile station 18. Preferably, in order to decompose a pilot wave's relative signal quality still more finely, various deltar (namely, two or more delta) may be used for deltar so that gradual delta may be used. A control processor 46 may make setting deltar which calculates threshold signal deltar continuously preferably and which is a substitute individual exception, of course, or was sorted out.

[0046]

As shown in drawing 6 , between the 1st frame, a pilot wave A is above equivalent to threshold signal deltar, or this, and this is set up by the pilot A itself by this example (that is, the pilot wave A has strongest SNR and, so, deltar is based on level deltadB below SNR set up by the pilot wave A). Moreover, there are no signals B and C above signal level deltar, an EQC, or this. Therefore, in the frame 1, it is above this and, as for drawing 6 , the pilot wave (the alphabetic character "A" written on the top of [time amount] shaft of the 1st frame shows like) A shows equivalent to signal deltar, or that it has the greatest average SNR to the past frame spacing. With a frame 2, strongest SNR is the thing of Signal A and, subsequently it is a pilot wave B, and the lowest pilot wave is C and the all are higher than deltar at the edge of a frame. With frames 3 and 4, only pilot waves A and B have come above deltar. With the frame 5, the pilot wave C has strongest SNR (so, deltar is calculated based on a pilot wave C). Subsequently, a pilot wave A is the strongest following signal, and it is larger than a pilot wave's B SNR, and those all are above deltar.

[0047]

The mobile station is collecting a lot of information effectively about the specific communication channel in a predetermined frame by calculating deltar by comparing deltar with each of each signal from the base station of an active set. In order to detect the signal transmitted from each base station the optimal, by designing the diver city receiver and the synthetic vessel of a mobile station, this characterization of a communication channel is utilizable with a mobile station. Furthermore, according to the operation gestalt of this invention, the engine performance of CDMA communication system is also optimized by communicating the quality of a pilot wave's best signal within an active set so that adjustment with a system control station equivalent about power allocation of the forward traffic channel between the base stations in an active set can be performed. it is shown in drawing 5 -- as -- the relativity of the signal from each base station -- since the number and selection with the optimal transmitting base station are not no longer fixed when SNR changes from a frame to a frame quickly, information communicates quickly to a system control station 10 (drawing 1).

[0048]

Moreover, delta value used in order to calculate deltar is saved beforehand at the mobile station, or it should be agreed a signal message or that some can be sent to a mobile station by other

control approaches. Moreover, please agree that drawing 5 and drawing 6 are described in the sense of the frame corresponding to the frame used for a traffic channel data framing, interleaving, and in order to carry out encoding as described by the IS-95 standard. However, it may not be required of this invention, and the frame shown in drawing 5 and drawing 6 may not be equivalent to specific processing spacing at all, and, as for this, may be short longer than the illustrated value for 20ms. Furthermore, the various transmission described above is generated by different base station. However, this invention is applicable also to the component which emits a forward link signal. Especially this invention is applied also to the antenna with which the same base stations to which the same signal is emitted differed. For example, the signals A, B, and C of drawing 5 and drawing 6 can also be taken out from the antenna with which the same base stations differed to one base station like [in case there are three antennas].

[0049]

Moreover, it should also be agreed that the set of the signals A, B, and C shown in drawing 5 and drawing 6 can be made into the thing from the combination of a base station or an antenna, or the combination of the antenna of one base station. For example, Signals A and B can be made into the thing from two different transmitting antennas of a base station 17, and Signal C can also be transmitted from a base station 19. Signals A, B, and C can also be made into the signal from a different antenna which may be the multiplex subcarrier forward link altogether transmitted from the same base station, or emits a multiplex subcarrier forward link. For example, supposing a base station 17 transmits three subcarriers from two antennas, Signal A consists of two subcarriers and Signal B consists of one subcarrier. By this example, although Signal A consists of two another different carrier signals, both will be emitted from the same antenna and these subcarriers will essentially be received by the mobile station on the same level, if transmitted on the same level. Moreover, it is also clear that there is a signal of three or more a large number which the mobile station is pursuing (shown in drawing 5 and drawing 6) in an actual system.

[0050]

In order to give this information quickly to a system control station 10 (drawing 1), this invention gives a new communications protocol between the mobile stations and system control stations 10 which were discussed on these specifications with reference to drawing 7 A - 7C. signaling in the form of a bit vector message where drawing 7 A - 7C was reported to the system control station (selector) 10 through the reverse link signal transmitted to the selector 10 by one or the base station beyond it (12 and 14) from the mobile station 18 — or the form of control messaging is shown. Although the much more frequent report and the report as for which between was further vacant in the list are also made into the alternative means, a bit vector message is preferably transmitted for every frame.

[0051]

With 1 operation gestalt of this invention, the multi-channel reverse link signal consists of the code channel the channel and the lot defined in Walsh code of a lot by the same approach as a forward link cross at right angles. In order to make into min a time delay until a system control station can act on the information included in a bit vector message in a setup of this multi-channel reverse link, as for a bit vector message, it is desirable to communicate through one of the code channels channels and a reverse link cross at right angles. The system and approach of transmitting data using such a reverse link signal are described for the United States patent application numbers 08/654,443 of the coincidence presentation entitled the "high data rate CDMA radio communications system" which it is transferred to the grantee of this invention of presentation on May 28, 1996, and have been included in this specification for reference.

[0052]

With another operation gestalt of invention, the reverse link signal of a single code channel is used as used for the IS-95 standard system. A data vector is transmitted to a bit vector message with other desirable user data within a single code time amount multiplexing or by carrying out bit blowout tea and making it a reverse link PN code.

[0053]

Drawing 7 A shows the DS of the pilot quality bit vector message which was started by the

mobile station and transmitted to the system control station 10 through the base station. Especially drawing 7 A has short die length, and shows 10 bit-vector message which can be reported to the system control station 10 with the quality of the signal which moreover became among the pilot waves of the active set of a mobile station more than a fixed criterion (for example, deltar threshold signal of drawing 6), or it. It may be other desirable however formats of those other than a bit vector for a bit vector message not to be limited to 10 bits, and to have a short message. In order to reduce the number of the transmitted bits, the bit vector message considers the arrangement of each pilot channel based on the sequence of a pilot wave's beginning checked from the system control station by the hand off instruction message to the mobile station.

[0054]

CDMA An IS-95 standard can be permitted to six members (pilot wave) in an active set, and those all can be put into a pilot quality bit vector message. In drawing 7 A, it is checked by the triplet data field index with which a pilot wave with the best thing (namely, the highest signal pair interference ratio) judged according to the process described with reference to drawing 6 checks specifically the location first reported to the mobile station by the hand off instruction message. An index is shown by the triplet data fields I1, I2, and I3 by drawing 7 A. In this way, if the pilot channel from the 2nd base station reported to the mobile station by the last hand off instruction message is received by the greatest SNR, a triplet index will be set to 2 (if binary 010), or it will be set to 1 supposing an index moves from 0 to 8.

[0055]

Bit fields U1, U2, U3, U4, U5, and U6 show whether the pilot channel which says each pilot wave first hung up by the hand off instruction message, and corresponds was respectively received above deltar threshold signal. For example, the bit of data field U1-6 is set to 1 (or 0), the pilot channel corresponding to the bit position is equal to deltar threshold signal, or being received more than by it is shown in the system control station 10. If U1 is especially set to 1, the 1st pilot wave of a system control station 10 checked by the last hand off instruction message being equal to deltar calculated by the control processor 46 in the signal-to-noise ratio in a mobile station, or having a thing above it will be admitted. U2-6 are preferably set on the basis for every frame by the processor 46, and they are transmitted to a system control station through the base station of a bit-vector message.

[0056]

It is the sequence number of the element of the last of a data field, Hm, and a ** hand off instruction message. A data field Hm is used in order to give the check of the active set which the mobile station is referring to to a system control station 10. Die length of Hm may be several bits, or it may be a single bit. In the case of a single bit, Hm may be the bit of the last of a sequence number. In this way, if the hand off instruction message in which the mobile station returned 1 by Hm supposing it was referring to the hand off instruction message of a sequence number 101, and it had a sequence number 100 if the hand off instruction message which ranked second equally to 100 which the base station sent, and had the sequence number of the number of 101 binaries was transmitted is referred to, 0 will be returned by Hm. By including a sequence number, base stations are the triplet data fields I1, I2, and I3, and it can be determined positively which pilot wave the mobile station is referring to by sets U1, U2, U3, U4, U5, and U6.

[0057]

With the operation gestalt of this invention including a multiplex subcarrier forward link, bit vectors U1, U2, U3, U4, U5, and U6 can be extended to a NxM bit, and there is a possible base station of N individual in an active set in that case, and there are M possible antennas in a base station. Or M can also be made equivalent to the number of the possible multiplex subcarrier forward links in a base station. the strongest thing of the NxM multiplex subcarrier forward link whose mobile station had vectors I1, I2, and I3 (it may need to check the largest thing among NxM items still longer) with this operation gestalt -- reporting -- **** -- moreover, the vector Ui -- using -- which -- others -- it reports whether a multiplex subcarrier channel is above deltar. another operation gestalt -- a mobile station -- Vector Ij -- using -- the base station rather strongest than the strongest subcarrier -- reporting -- subsequently -- Vector Ui --

using -- which -- others -- it reports whether a multiplex subcarrier channel is above deltar.
[0058]
deltar -- the strongest base station -- being related -- or it should be further careful of whether for it to be the strongest subcarrier among all the base stations of the active set of a mobile station, and to obtain. It should be further careful of the ability of the strongest base station to be determined by totaling pilot Ec/I0 from all the forward link subcarriers of a multiplex subcarrier base station as are used in common by IS-95, and carried out of the multi-pass component from the same subcarrier. In this way, the reinforcement of the sum total of a base station is obtained by totaling Ec/I0 from all the multi-pass components of all forward link subcarriers and a specific subcarrier.
[0059]
A bit field message is answered, a system control station 10 receives the measured power message, and it is determined which to remove from a forward traffic channel among the signals of an active set so that this specification may discuss, and which is made to continue transmitting among base stations. That is, it checks whether the system control station 10 has transmitted the signal with which which base station is received below deltar threshold signal using the bit field message. If it directs that it stops that a system control station 10 transmits the traffic channel turned to the mobile station corresponding to the base station checked next and it is done so, the mobile station will lower the transmitting force of the forward link signal generated by these base stations. With another operation gestalt, a base station determines whether instead of a system control station, a message should be received and it should transmit a forward link. This approach reduces delay, however since all base stations (or base station which has transmitted the forward link) may not receive reverse link transmission, dependability may be thin [an approach] when the mobile station is a software hand off.
[0060]
A base station answers by not transmitting a traffic channel among the frame next to the data turned to the corresponding mobile station. Since the signal from the checked base station is received by the mobile station 18 by low SNR more remarkable than other at least one forward link signal, the increment in the error rate of a mobile station is small in proportion to the fall of the transmitting force of all systems. Even if it stops that the checked base station transmits a traffic channel, the signal process source in those base stations remains assigned, and if there is a demand by the system control station 10, it is ready to begin to transmit a traffic channel. Moreover, these base stations continue processing the reverse link signal preferably transmitted from the mobile station 18.
[0061]
A mobile station 18 continues supervising the related reinforcement of the pilot wave who received from the base station of an active set as a communication link continues. If a pilot wave's condition changes, for example a pilot wave will receive the signal above deltar threshold, a mobile station 18 will show that this change is just, and will generate another bit field message. A mobile station 18 will generate a bit field message, if a pilot channel with the best SNR changes again. According to a situation, it is directed whether a system control station 10 suspends that it is begun whether to transmit a traffic channel and transmission of a traffic channel to the mobile station in a base station with the active set from which the bit field message was received and the situation changed. each base station answers transmitting the following data frame via a traffic channel, if come out and it is so that directions may begin transmission, or by not transmitting the following data frame, if come out and it is so that directions may suspend transmission of a traffic channel.
[0062]
With another operation gestalt of invention, a mobile station 18 generates a bit field message once per each frame periodically. By maintaining the source assigned in each base station for transmitting a traffic channel, a traffic channel can be inactivated in response to the situation of it being activated quickly and changing quickly.
[0063]
With still more nearly another operation gestalt of this invention, the system control station 10

includes the gain control field in the nucleus data frame sent to the base station. The gain control field shows the transmitted power gain to which a frame should be transmitted from a base station. When a system control station 10 receives the vector which shows that the pilot channel from a specific base station is received below deltar threshold signal lower than the strongest pilot channel, the gain control of the following frame turned to the subscriber is lowered. When much more many vectors show that the pilot channel from the base station stops at deltar threshold below the strongest pilot wave, a subsequent frame can be reduced further.
[0064]
Since a control system 10 defines better the stability of the environment where the mobile station is operating again, it may perform analysis to which the bit vector which received progressed further. Especially the control system 10 may supervise the rate which changes from the place which has a specific pilot channel above deltar threshold or in the bottom. If rate of change exceeds a predetermined threshold, since the mobile station has disappeared or a control system 10 is in an unstable environment, it is decided that it will be making the signal from each base station of a software hand off transmit succeedingly. Even when a control system 10 is compared to all the base stations by which the active set is carried out when such decision is made, and deltar threshold with a certain pilot channel lower than the best receiving pilot channel is detected, it directs to transmit a forward link traffic channel succeedingly.
[0065]
Drawing 7 (B) shows another DS of the pilot quality bit vector message transmitted to the system control station 10 through the base station from the mobile station. However this another operation gestalt is the same as the DS defined as drawing 7 A, 5 bits which checks 6 members of an active set are only included. Only 5 bits is used, because it is because the 6th check (namely, base station which gives the strongest S/N) is checked by the triplet of the beginning of a pilot quality bit vector message (namely, I1-3). By checking the strongest signal of the triplet of the beginning of a pilot quality bit vector message peculiar, a tacit understanding of not carrying out carrying out the bit check of the location of the strongest base station is carried out, and each of other members of an active set is serially checked by the bit of the after that of a pilot quality bit vector message.
[0066]
Drawing 7 C shows a format of still more nearly another pilot quality bit vector message which checks the strongest pilot wave of the base station of an active set, the following triplet strong against the second, J1-3 and a member's triplet strong against the third, and K1-3 peculiar using triplet I1-3 of the beginning. In this way, of three strongest pilot waves' of the member's of an active set's each is checked peculiar. Extension of this operation gestalt adds three additional bits to the strongest pilot wave of the 4th and the 5th **** [6th] from the member of an active set, and checks these peculiar. Moreover, the further operation gestalt adds an additional bit to a message, and it shows the related reinforcement of the pilot wave of rather still finer quantum level rather than it only calls it a threshold deltar top or the bottom. Still more nearly another operation gestalt includes all Ec/Io values in each pilot wave. in this way, a system with a pilot wave with the six possibility of an active set -- receiving -- an active set -- each -- Ec/Io is included in a possible pilot wave. It is clear that send [the related Ec/Io value which is proportional to the greatest pilot wave about Ec/Io of the greatest pilot wave of an active set at delivery and a degree] it is another possible operation gestalt. Although each of the operation gestalt of drawing 7 A - drawing 7 C specifies the option which reports the related measurement power in the foundation for every frame preferably, of course, it is also possible to combine an option. for example, the first two strongest pilot waves of a member base station can be checked using the first 6 bits of the measured power message, and the following three strongest pilot waves' relative position can also be checked about five members' set namely, -- using the following three bits.
[0067]
Another another approach has an independent base station for transmitting to a mobile station. In this case, it is necessary to transmit only three bit vector messages (namely, I1-3) to a base station from a mobile station. In another arrangement, it must have the multiplex subcarrier base

station transmitted via one antenna at once. In this case, which antenna an independent bit uses and to specify are required. Needless to say, a bit can be used combining the approach to which it is explained above.
[0068]
When communicating on the well-known first or a late fading channel, in order to conquer the bad influence of fading more effectively, another operation gestalt for determining deltar threshold is used. Objectively [the desirable operation gestalt on the basis of the average pilot wave to whom deltar has the largest S/N ratio on a frame], in this operation gestalt, the minimum value of the maximum pilot wave on a frame is used in order to determine threshold deltaR. Therefore, even if the even if strongest pilot wave receives fading, he can act as more pilot waves more than deltar threshold by setting threshold deltar as the minimum of the strongest pilot wave on a frame. Therefore, a signal can be combined more from many base stations, therefore a lot of diversity gain can be attained [add / at least / independence or / much / half-independent pass] more. More specifically in the first fading environment, the fading period should usually operate [the use explained to the above of the minimum value to the strongest pilot wave on a frame] appropriately to the scenario of comparatively short first fading to the die length of a frame.
[0069]
However, the interleaver used in a receiving process does not bring about profits for the more usual case, and a lake receiver and the mobile engine performance do not have the forge-fire engine performance mainly large when the period of fading is shorter than the period of an interleave in a first fading environment to late fading. However, in order to give the quality of the communication link which can admit mobile **, bigger Eb/No. is required of late fading when the period of fading is longer than the span of an interleaver. Furthermore, the period of one frame for equalizing a related pilot wave's reinforcement is not enough to determine whether have received fading with a late related communication channel.
[0070]
Therefore, in an operation gestalt, each of a related base station carries out the filter which unifies and normalizes each of Uk bit in a bit vector message (refer to drawing 7 A and 7B). Each of Uk bit toggles (it changes to two conditions), namely, when changing a condition once [at least], the channel from which the base station and mobile station with which this toggle is related have received late fading shows that late fading is received. Therefore, the system performance of a CDMA system improves, when the base station which has received late fading is continuing transmitting on a forward traffic channel. It can be used as an indicator of a system control station to show whether in the toggle action observed, a mobile station should be put on a software hand off field again. For example, when the bit field which shows the pilot reinforcement to the given base station is always about 0 or is always 0, since this office does not apply a profits value at all as a matter of fact to the engine performance of a mobile station, the base station which had to show that a related base station had a more sharply [than a pilot wave with strong ******] weak pilot wave, and has made the weaker pilot wave must not be included in an active set. Moreover, only when a mobile station supervises toggle actuation effectively and this office wishes to change the base station transmitted to the mobile station, it cannot be overemphasized that a message can be transmitted to a base station.
[0071]
With another operation gestalt, it can change to signal transmission and a process can be performed more quickly. In this case, a mobile station transmits between fading, when a base station becomes stronger than one piece or the signal from other base stations beyond it or becomes weak, and it transmits a signal to a base station directly. A base station answers without [without it transmits, or] transmitting the following frame. In this case, since the 1st frame can be made to be able to transmit from one base station and the frame following a degree can be made to transmit from the base station of another side, a base station can answer more quickly than the control unit of a base station, and can make a change rapid. This operation is comparatively useful at the fading rate like inside. Even if signal transmission and a change are rapid, they can make a change cause between frames. In one operation gestalt, a base station

encodes and interleaves the data for transmission, and processes them further. Un-operating-izing [flow of the output of data is actuation-ized based on the feedback from a mobile station, or].
[0072]
As an alternative plan of the threshold method for determining which pilot wave in a pilot quality bit vector is specified, the 2nd "finger allocation" is explained in this specification. In being mobile, a mobile station estimates pilot Ec/Io received from the base station in all active sets. it is mobile -- when it does not have the finger of the diversity receiver of equipment, Ec/Io to a pilot wave is set as 0. When it has the finger of the diversity receiver with which the mobile station was assigned to the given base station, a numeric value is reported after determining average (or it is more long or it is desirable that short averaging time can be used) Ec/Io over 20 mses of mobile ** and a front. The period of 20 mses corresponds to CDMA frame length. A mobile station specifies the greatest Ec/Io value and the greatest pilot wave who has the assigned index Am. To all other pilot waves in an active set, a mobile station sets the bit value to which it relates in a bit vector message as 1, when the Ec/Io value to a pilot wave is deltar within the limits of the Ec/Io value to the greatest pilot wave. More than N pilot wave is not reported into a bit vector message that N is six or less when a receiver has only N finger.
[0073]
Since a finger can be assigned to the both sides of direct signal pass and image pass (namely, multi-pass image), it prevents that the finger allocation approach receives a report as that in which "too many" base stations have a mobile more usable signal. For example, when the diversity receiver has three fingers and only two base stations have made the signal of the three highest quality (namely, direct pass from each base station and an image signal), since the receiver does not have sufficient finger for receiving a signal, it does not need the 3rd base station for transmitting mobile. On the other hand, since there is an example of a large number referred to as that a diversity receiver compounds the signal from the 3rd base station when the pilot wave from the 3rd base station exceeds one of the three signals of other periodically, it may carry out in case of more than the threshold that he mobile-**, nevertheless wishes, and may report to all three stations. Therefore, the pilot SN ratio to a base station is reported in one operation gestalt of this invention by the highest SN ratio from a base station based on a finger.
[0074]
Drawing 8 is a flow chart which shows the desirable approach, in order to adjust forward channel power allocation. a process is mobile — it is started at step S1 which measures the pilot reinforcement (signal quality) of all the pilot waves of a mobile active set within the limits. A process progresses to step S3 which generates threshold signal deltar based on the pilot reinforcement measured in step S1 here. Signal deltar is generated based on the pilot wave who has the greatest SN ratio as measured in step S1. The pilot wave and pilot wave i of a process who are related here are larger than deltar, or it progresses to the step S5 equal to it. If it can do, as for a comparison step, it is desirable that they are performed over the frame period of 20 mses, and are completed by the end of a frame period although other sample sampling intervals taken up in respect of the others within the limits of a frame or in multi-framing are in agreement with this operation gestalt. The related pilot wave i is larger than deltar, or when equal to it, the bit in the bit vector message which shows the related pilot wave i (for example, refer to drawing 7 A-7C) has him. [larger than threshold deltar] However, it is set up so that it may be shown that a pilot wave i is not larger than deltar in step S5, or the related pilot wave i of the bit in a bit vector message is smaller than deltar, or it is equal to it when being equal to it is determined (if it can do, it is desirable to set a bit as "0").
[0075]
the process of a bit vector is mobile after a pilot quality bit vector is formed in step S7 or step S9 -- it progresses to step S11 which transmits a bit vector message to the base station in a mobile active set. at this time, it is mobile based on the mobile anticipation of a system control station 10 which adjusts the power in a forward traffic channel corresponding to an early mobile ** and mobile bit vector message -- the timing loop mobile [as an indicator for / which determines when a finger is adjusted / being mobile] and used is set up. By setting up a timing

loop (it being able to attain mobile more easily by calculating the frame of continuous 20 mses), it knows when it was changeful in mobile ** and forward traffic channel transmission. A process progresses to S13 which a base station relays to a system control station after receiving a pilot quality bit vector after step S11. since the selector in the place of a system control station carries out bit vector message processing of the process after step S13 -- which base station under mobile set under actuation -- a mobile active set progresses to step 15 which generates the control message transmitted to each of the related base station which controls whether a related code channel must be transmitted mobile. The total power emitted from the base station in a mobile active set by controlling transmission from each of the base station in a mobile active set is reduced.

[0076]

A process progresses to step S17 which adjusts mobile ** and a finger in the base station which was equal to signal deltar as determined in step S7 and S9, or was pinpointed as a larger thing, and a corresponding diversity receiver, after a timer reaches a time amount threshold. The energy with which it was received only from base stations in the mobile active set which is carrying out fact transmission on the code channel which mobile-** and is related by adjusting a finger, such as this, is compounded. after step S17, a process is mobile -- it repeats supervising succeedingly the related pilot reinforcement to each base station in a mobile active set.

[0077]

Since a mobile station generates a specific bit vector message and the response to the bit vector message of each base station is due to the algorithm set up beforehand again, the time amount by which each base station changes forward link allocation is known by the mobile station. Therefore, a mobile station can combine correctly the signal only from the base station then transmitted. Since combining the signal from the base station which has not been transmitted to a specific mobile station may cause an unnecessary noise introduced into the receiving process which has a bad influence on a result, this function is an advantage. There is a possibility of producing engine-performance loss and the higher loss of Eb/No and capacity needed as a result, about an operation of a noise. Similarly, a mobile station is transmitted to a mobile station, and when the signal received from the big value is not compounded, there is a possibility of becoming loss of capacity.

[0078]

In one operation gestalt of this invention, a message is received correctly and a mobile station amends the error for the transmission to which it is in charge of reception of the bit vector received by each base station by the attempt of the beginning for restoring to the forward frame received as what was processed by the base station. In most cases, a mobile station restores to a frame correctly, but when the frame serves as an error, a mobile station may try to use the set of the base station transmitted to the mobile station, before a base station transmits the latest bit vector message. Therefore, when a base station does not receive the newest bit vector message, while a mobile station uses the set of the base station used before, there is a possibility of trying to restore to a frame again. For this operation, a mobile station needs to maintain the signal received from the various sets of the base station in a buffer. Then, when a mobile station has an error, the data in a buffer will be used for it. Error correction processing is illustrated as it is shown by the broken line to step 19 and is in steps S19 and S21 as an option of drawing 8 .

[0079]

Drawing 9 is the flow chart of the option for changing the forward traffic channel power allocation for the base station in a mobile active set. a process is mobile -- it is step S32 which measures the pilot reinforcement to which each base station in a mobile active set relates, and is started. Next, threshold signal deltai based on the mobile ** and pilot reinforcement who were measured is generated in step S34. And after comparing the both sides of a multi-pass signal with it being direct (direct 1), a multi-pass signal compares direct, a multi-pass, or both sides, in order [which receives each of the base station which mobile-** and is related in step S36] to decide [direct or] whether it is larger than deltar or equal to it. A multi-pass image is larger than deltar, or when equal to it, as for a process, the diversity receiver progresses a finger

(plurality is included) to direct [larger] or larger step S38 assigned to a multi-pass signal or its both sides than deltar direct or as it was determined in step S36. next, any of the direct or the multi-pass signal of a base station which are related in step S36 although a process progresses to step S42 -- although -- or it is not larger than deltar -- case it is not equal -- a process -- the finger of a lake receiver, and a synthetic vessel circuit -- it progresses to step S40 by which neither is assigned to the specific base station. A process progresses to step S42 there. deltar in drawing 9 must care about differing from delta in drawing 7. Although used for determining whether deltar reports a pilot wave in drawing 8 , delta is used for determining whether assign the finger of a lake demodulator in drawing 9 . Similarly, generally deltar in drawing 9 is smaller than delta of drawing 7.

[0080]

In step S42, the bit vector message which shows the finger allocation made from mobile ** and a place direct mobile on a multi-pass signal is transmitted to a base station and an active set. either direct or a multi-pass signal -- although -- when larger than deltar, a multi-pass image formats the mobile ** and bit vector message which shows that it is larger than deltar or direct at least or equal to it. A process progresses to step S44 which relays a bit vector message to the selector in the place of the control unit of a system, in order to enable it to adjust the forward traffic power allocation which a system control station is told about the finger allocation used in the mobile place from it, therefore which base station to each of the base station in a mobile active set transmits to a mobile station. A process progresses to step S46 which a selector transmits to the base station in the mobile active set in which it is shown which base station should transmit a control message on the related code channel corresponding to the finger allocation set up more mobile from it. A base station relays a control message mobile so that a mobile station may receive the notice of a purport whose base station received the notice about allocation of the system control station of forward traffic channel power. a process -- and it is mobile -- it progresses to step S48 which adjusts the finger in a diversity receiver corresponding to the control message generated by the system control station.

[0081]

It must care about [a base station or] whether it is an error any of the control message transmitted to the mobile station from the base station they are from a mobile station. The same technique as what was explained in relation to drawing 7 can be used. In this case, when a mobile station does not receive the control message from a base station, or when a mobile station receives a frame in an error, a mobile station can restore to the set of the base station before having transmitted to a mobile station.

[0082]

the inside of the approach for changing another forward traffic channel power allocation -- S15 from step S1 ****** -- a base station -- moreover -- mobile -- again -- which base station -- **** -- it has transmitted on the forward traffic channel to which this office relates -- although it carries out transmitting that display, it is the same as what is shown in the desirable approach of drawing 8 . Therefore, it is not mobile in another operation gestalt, and controls which base station transmits a system control station mobile.

[0083]

This inventions have been explained by the semantics which sets up threshold deltar relevant to a pilot wave with the strongest reinforcement as they were explained to be a text and drawing 5 in 6. Much another metrics can be used. Only when a pilot wave makes sum total Ec/Io fully increase especially, what sets up '1' from a bit U1 can be used again. This technique is transferred to the grantee of this invention of the application number 08/No. 790,497 entitled "the approach and equipment" for carrying out the software hand off in a radio communications system, and is explained in the concurrency application United States patent built into this specification by the citation.

[0084]

This invention is explained by the semantics which transmits the whole forward link from the set of a base station and a mobile station. The system and approach for carrying out fundamental high speed datalink which uses an auxiliary channel again The inside of the concurrency United

States patent application number 08/No. 798,949 of the title called "transmission power reduction for the high-speed CDMA link in a software hand off" by which both sides are transferred to the grantee of this invention, and are incorporated in this specification by the citation, Moreover, it is explained in the concurrency application United States patent application number 08/No. 784,281 of the title called "high-speed-data velocity aid channel for CDMA communication system." The forward link is divided into the base and the auxiliary channel in the high speed datalink system. A basic channel is continuously transmitted from a base station in an active set. An auxiliary channel is transmitted from the same base station as a subset of a basic channel or a channel. This invention currently explained in this specification is applicable to a basic channel, an auxiliary channel, or its both sides.

[0085]

Drawing 10 is the spectrum Fig. of a multiplex subcarrier diffuse-spectrum forward link and an independent subcarrier broadband diffuse-spectrum link. Although not completely shown by scale, the diffusion region bandwidth to each subcarrier is shown as 1.25MHz to the measure of a multiplex subcarrier, and a diffusion region bandwidth is 3.6864MHz to the measure of the broadband of an independent subcarrier. The measure for a multiplex subcarrier has various advantages including being able to transmit each subcarrier from the antenna of a different configuration, offering a characteristic fading pattern to each subcarrier so that fading of another side and all three subcarriers may be reduced to coincidence, therefore intercepting a communication link.

[0086]

Drawing 11 is the block diagram of the multiplex subcarrier transmitting system formed according to one of the operation gestalten of this invention. The notation which the input data was encoded by the **** condition, and was punched and encoded with the conventional convolution encoder 100 is repeated with the notation iteration vessel 102, and is added to additional redundancy. The notation which the Brock interleaver 104 was arranged by turns at intervals of the time amount of 20 mses in the repeated sign, and was arranged by turns is scrambled via XOR gate 106 in decimal-number-system-ized long code which was generated by the long code generator 108 and long DESHIMETA 110 corresponding to a user's long code mask. The scrambled notation is divided into the flow of the notation transmitted on the carrier signal respectively related with a demux 112.

[0087]

The map of the flow of a related notation is carried out to QPSK by the QPSK mapper to each carrier signal. A QPSK notation is respectively modulated with the same Walsh code modulator 116, and the Walsh chips made as a result are the inphase diffusion code PNi and 4 phase diffusion code PNQ further, and are modulated by dispersion equipment 118. If it can do, as for PNI and PNQ, it is desirable that it is the same to each subcarrier. As for the diffusion notation produced as a result, being transmitted is desirable after being converted with the equipment (up converter) with which each raises a frequency to a peculiar frequency there, if it can do. Although drawing 11 shows the modulation by the same Walsh channel code to each subcarrier, the Walsh channel codes may differ.

[0088]

Drawing 12 is some block diagrams of the receiving system for processing the multiplexer-channel signal when being constituted according to one operation gestalt of this invention used more mobile. The energy of the radio frequency to which the frequency was lowered with the down converter is filtered by 5MHz with a band-pass filter 200, and a sample extract is carried out by A/D202 at the rate of 8X1.2288. In a filter bank 204, the frequency of the sample of two 1.25MHz parts is a digital method further, and it is based on the 1.2MHz oscillator (NCO) by which numerical control was carried out, or is lowered to baseband by 1.25MHzNCO(s) and 2.5MHzNCO(s) as an option, and the set of three samples is filtered by 1.25 **** with a low-pass filter. This low-pass filter can be used as the part of the filter adjusted by the receiver or a filter. The data filtered with the low-pass filter produced as a result are passed to the lake receiver 210, and a receiver is compounded after restoring to the example of the various multi-passes of the transmitted signal. After being sent to deinterleaver and decomposed from a

mutual array, the double sign of the compounded soft decision data which were produced as a result is carried out.

[0089]

Needless to say, much reconstruction and deformation of this invention are possible in the light of the aforementioned explanation. Therefore, this invention shall be interpreted as what can be carried out even except that it is concretely explained in this specification within the limits of the claim of separate attachment.

[Brief Description of the Drawings]

When thinking in relation to the drawing of separate attachment, he can acquire the advantage which a majority of perfect understanding of this invention and this inventions accompany by quoting the following detailed explanation, and can understand it well again.

[Drawing 1]

Drawing 1 is the block diagram of the CDMA cellular telephone system as an example according to this invention.

[Drawing 2]

Drawing 2 is the field of the software hand off on the graph of the quality pair time amount of a pilot channel, and this graph.

[Drawing 3]

Drawing 3 is a mobile block diagram.

[Drawing 4]

Drawing 4 is a graph which shows the example of the probability of framing error **** Eb/No to the various figures of the base station transmitted as received by N finger diver city receiver.

[Drawing 5]

Drawing 5 is a graph which shows the Ec/Io pair time amount of the software hand off field to three pilot waves as an example within the limits.

[Drawing 6]

Drawing 6 is the same graph as what was shown in drawing 7 A with the addition of threshold signal deltar formed below on the highest pilot level.

[Drawing 7 A]

Drawing 7 A is drawing of the 1st DS to the bit vector message which shows the quality of a channel.

[Drawing 7 B]

Drawing 7 B is drawing of the 2nd DS to the bit vector message which shows the quality of a channel.

[Drawing 7 C]

Drawing 7 C is drawing of the 3rd DS which receives the bit vector message which shows the quality of a channel.

[Drawing 8]

Drawing 8 is the flow Fig. of the sequence of the message for reducing the amount of the whole forward traffic channel power transmitted from the base station in an active set when excessive power is transmitted.

[Drawing 9]

Drawing 9 is the flow Fig. of the sequence of another message for reducing the amount of the whole forward traffic channel power transmitted from the base station in an active set when excessive power is transmitted.

[Drawing 10]

Drawing 10 is drawing of a multiplex subcarrier forward link.

[Drawing 11]

Drawing 11 is the block diagram of the transmitter of a multiplex subcarrier forward link.

[Drawing 12]

Drawing 12 is the block diagram of a multiplex subcarrier forward link receiver.

[Translation done.]

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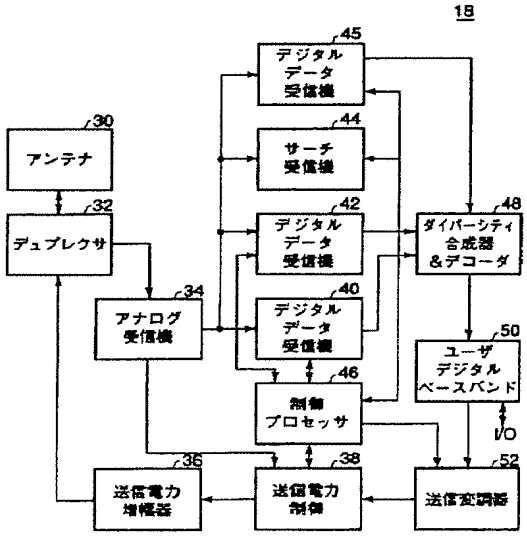
最終頁に続く

(54)【発明の名称】　ソフトハンドオフの間のフォワードトラフィックチャネル電力割当を変更するための方法とシステム

(57)【要約】
【課題】　ソフトハンドオフの間のフォワードトラフィックチャネル電力割当を変更するための方法とシステム
【解決手段】　フォワードトラフィックチャネルの電力割当を調整するためのシステムであって、システムの中で、多重基地局（１２、１４、１６）によりそれぞれ送信されるパイロットチャネルの信号の質が、活動中の一組の移動局（１８）により計測され、信号品質基準と比較されてから、比較の結果が、システム制御装置（１０）に応答して、この作用で、移動局（１８）のどのパイロットが基準を越えているかを示すもの。システム制御装置（１０）は、それから、比較結果を基準としてフォワードチャネル電力割当を調整する。



【特許請求の範囲】

【請求項１】　通信システムにおけるフォワードトラフィックチャネル電力割当てを調整する方法であって、

移動局のアクティブセットにおける、複数の基地局によってそれぞれ送信されたパイロットのそれぞれの信号品質を前記移動局で測定するステップと、

前記パイロットの前記それぞれの信号品質を基準と比較するステップと、

前記移動局での前記パイロットのどれが前記基準と等しいか、あるいはそれを超えているかを示すメッセージをシステム制御装置に報告するステップと、

前記メッセージに基づいて前記フォワードトラフィックチャネル電力割当てを調整するステップとからなる方法。

【請求項２】　前記比較するステップは、

予め決められた時間間隔に亘って最大の測定信号品質を有する前記パイロットの少なくとも一つに基づいてしきい値を前記基準として発生させるステップと、

前記パイロットの前記それぞれの信号品質の各々を前記しきい値と比較するステップとを含む請求項１記載の方法。

【請求項３】　前記報告するステップは、

前記パイロットのそれぞれの信号品質を表す値を予め決められた順序でリストアップされたビットベクトルを発生させるステップと、

前記パイロットのどれが最大の測定信号品質を持っているかを識別するインデックスを前記ビットベクトルリストに含めるステップとからなる請求項２記載の方法。

【請求項４】　前記報告するステップは、ＣＤＭＡ　ＩＳ－９５プロトコルのすべてのフレームについて少なくとも一度は前記ビットベクトルをシステム制御装置に報告することを含む請求項３記載の方法。

【請求項５】　前記報告するステップは、ＣＤＭＡ　ＩＳ－９５プロトコルの複数のフレームと前記フレームの部分との少なくとも一つにおいて前記ビットベクトルを前記システム制御装置に報告することを含む請求項３記載の方法。

【請求項６】　前記通信システムはＣＤＭＡ　ＩＳ－９５通信システムを含んでおり、前記通知するステップは周期的または非周期的いずれかで前記ビット

ベクトルを通知することを含む請求項３記載の方法。

【請求項７】　前記測定するステップは、前記パイロットに関するそれぞれの信号対干渉比を測定することを含み、

前記発生させるステップは、前記パイロットに関する前記それぞれの信号対干渉比の最大値の少なくとも一つに基づいてしきい値を発生させることを含む請求項２記載の方法。

【請求項８】　前記発生させるステップは、予め決められたレベルを前記それぞれの信号対干渉比の最大値から減じてしきい値信号を生成することを含む請求項７記載の方法。

【請求項９】　前記それぞれの信号対干渉比の最大値は最小値を持っており、前記比較するステップは、前記パイロットの前記それぞれの信号品質の各々を前記パイロットの前記信号対干渉比の前記最大値の最小値と比較する請求項８記載の方法。

【請求項１０】　前記リストアップするステップは、前記移動局の前記アクティブセットにおいて前記基地局を予め決められた順序で識別するハンドオフ命令メッセージを受信するステップと、

前記順序に対応するように前記ビットベクトルのそれぞれのデータフィールドを配列するステップと、

前記パイロットのそれぞれが前記しきい値信号を超えるかどうかを示すそれぞれの値を前記それぞれのデータフィールドに配置するステップとをさらに含む請求項３記載の方法。

【請求項１１】　前記受信するステップは、前記パイロット信号に対応する１セットの受信ダイレクトおよびマルチパス信号を受信し、受信ダイレクトおよびマルチパス信号の前記セットは、その各々が前記Ｎ個の受信ダイレクトおよびマルチパス信号のサブセットには存在しないサブセットの信号の各々よりも大きい信号対干渉比を示すＮ個のダイレクトおよびマルチパス信号のサブセットを含むことと、

前記配置するステップは、前記パイロットの前記それぞれが前記サブセットのＮ個の受信ダイレクトおよびマルチパス信号の少なくとも一つに対応する場合に

のみ、前記しきい値信号を超える前記パイロットのそれぞれを示す前記それぞれの値を前記それぞれのデータフィールド内に配置する請求項１０記載の方法。

【請求項１２】　現在のアクティブセットと過去のアクティブセットと将来のアクティブセットのうちの少なくとも一つが識別し得るアクティブセットデータフィールドを前記メッセージに追加するステップをさらに含む請求項１０記載の方法。

【請求項１３】　前記測定するステップは、前記アクティブセットにおいて前記複数の基地局のそれぞれ一つの少なくとも一つのセクタによってそれぞれ送信されたパイロットの信号品質を測定することを含む請求項１記載の方法。

【請求項１４】　前記調整するステップは、前記基地局のどれがそれぞれのコードチャネルを前記移動局に送信すべきであって、どれがそれぞれのコードチャネルを前記移動局に送信すべきでないかを示すフォワードトラフィックチャネル電力割当て制御コマンドを形成することと、

前記アクティブセットにおいて前記複数の基地局に前記フォワードトラフィックチャネル電力割当て制御コマンドを通知することとを含む請求項１記載の方法。

【請求項１５】　前記メッセージが前記移動局から最初に報告されたときに前記移動局でタイミングメカニズムを起動するステップと、

前記メッセージが最初に前記移動局から報告されたときと前記フォワードトラフィックチャネル電力が調整されたときとの間の時間的な差に対応する遅延時間がいつ経過したかを観測するステップとをさらに含む請求項１記載の方法。

【請求項１６】　前記移動局のダイバーシティ受信機の少なくとも一つのフィンガのフィンガ割当てであって、前記基準に等しいか、またはそれを超える、前記報告するステップで前記メッセージ内で報告された前記パイロットに対応する前記フィンガ割当てを変更するステップをさらに含む請求項１５記載の方法。

【請求項１７】　前記形成するステップは、Ｎが前記移動局におけるダイバーシティ受信機のフィンガ数に対応する場合に、Ｎ個以下の前記基地局がそれぞれのコードチャネルを前記移動局に送信すべきであることを示す前記フォワードトラフィックチャネル電力割当て制御コマンドを形成する請求項１４記載の方法

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【請求項１８】　前記比較するステップは、ダイバーシティ受信機の少なくとも一つのフィンガが基地局からのコードチャネル信号に割当てられているかどうかを決定することを含んでおり、

前記報告するステップは、少なくとも一つのフィンガに割当てられたそれぞれのコードチャネル信号を前記基地局のどれが供給するかを報告することを含んでいる請求項１記載の方法。

【請求項１９】　前記報告するステップは、前記パイロットのそれぞれの信号品質を表す値を予め決められた順序でリストアップするビットベクトルを発生させるステップを含む請求項１８記載の方法。

【請求項２０】　前記報告するステップは、それに割当てられた少なくとも二つのフィンガを有する前記複数の基地局の一つを識別するインデックスを前記ビットベクトルに含むステップを含む請求項１９記載の方法。

【請求項２１】　前記報告するステップは、ＣＤＭＡ　ＩＳ－９５プロトコルのすべてのフレームについて少なくとも一度は前記ビットベクトルをシステム制御装置に報告することを含む請求項１９記載の方法。

【請求項２２】　前記報告するステップは、ＣＤＭＡ　ＩＳ－９５プロトコルの複数の前記フレームと前記フレームの部分の少なくとも一つについて前記ビットベクトルを前記システム制御装置に報告することを含む請求項１９記載の方法。

【請求項２３】　前記通信システムはＣＤＭＡ　ＩＳ－９５通信システムからなり、前記通知するステップは周期的または非周期的いずれかで前記ビットベクトルを通知することを含む請求項１９記載の方法。

【請求項２４】　前記発生させるステップは、

前記アクティブセットにおいて予め決められた順序で前記複数の基地局を識別するハンドオフ命令メッセージを受信するステップと、

前記順序に対応するように前記複数の基地局の各々について前記メッセージ内にそれぞれのデータフィールドを配列するステップと、

前記ダイバーシティ受信機の前記少なくとも一つのフィンガが前記複数の基地

局にそれぞれ割当てられているかどうかを示すそれぞれの値を前記それぞれのデータフィールド内に配置するステップとをさらに含む請求項１８記載の方法。

【請求項２５】　現在のアクティブセットと過去のアクティブセットと将来のアクティブセットのうちの少なくとも一つが識別し得るアクティブセットデータフィールドを前記メッセージに追加するステップをさらに含む請求項２４記載の方法。

【請求項２６】　前記パイロットは複数の搬送波信号上で伝送される請求項１記載の方法。

【請求項２７】　前記複数の搬送波信号は、対応する複数の異なる構成のアンテナから送信される請求項２６記載の方法。

【請求項２８】　それぞれのパイロットとフォワードトラフィックチャネルを含むそれぞれのコードチャネルとを送信する複数の基地局と、

前記複数の基地局に通信可能に接続されたシステム制御装置と、

そのアクティブセットに割当てられた前記複数の基地局を有する移動局とからなる通信システムにおいて、

前記移動局が、

前記パイロットのそれぞれの信号品質を測定するダイバーシティ受信機と

信号品質基準を生成し、前記パイロットの前記信号品質のどれが前記基準と等しいか、またはそれを超えているかを示すメッセージを準備するプロセッサと

前記メッセージを前記システム制御装置に直接、あるいは前記複数の基地局を経由して送信する移動送信機とからなり、

前記システム制御装置が前記メッセージの受信に応じて前記フォワードトラフィックチャネルの送信電力レベルを調整する通信システム。

【請求項２９】　前記移動局の前記プロセッサは、

予め決められた時間間隔に亘って最大の測定信号品質を有する前記パイロットの少なくとも一つに基づいて前記基準としてしきい値信号を発生させるしきい値発生メカニズムと、

前記パイロットの前記それぞれの信号品質を前記しきい値信号と比較する比較メカニズムとを含んでいる請求項２８記載の通信システム。

【請求項３０】　前記移動局の前記プロセッサは、前記パイロットのそれぞれの信号品質が前記しきい値信号と等しいか、またはそれを超えているかどうかを表す値のリストと前記パイロットのどれが最大の測定信号品質を有するかを識別するインデックスとを含むビットベクトルを前記メッセージ内に発生させるメッセージフォーマッティングメカニズムを含む請求項２９記載の通信システム。

【請求項３１】　前記移動送信機は、ＣＤＭＡ　ＩＳ－９５プロトコルのすべてのフレームについて少なくとも一度は前記ビットベクトルを送信する請求項２９記載の通信システム。

【請求項３２】　前記移動送信機は、ＣＤＭＡ　ＩＳ－９５プロトコルのフレームとフレームの部分との少なくとも倍数だけ、前記ビットベクトルを送信する請求項３０記載の通信システム。

【請求項３３】　前記ダイバーシティ受信機は、

前記パイロットの前記それぞれの信号品質を測定するパイロット受信機と、

各々が基地局からダイレクトパスとマルチパスの少なくとも一つを経由して前記コードチャネルの少なくとも一つを受信するＮ個のフィンガとからなる請求項２８記載の通信システム。

【請求項３４】　前記プロセッサは、

前記コードチャネルに対応する他のすべての信号より大きい信号対干渉比を示す前記コードチャネルの前記少なくとも一つのＮのサブセットに前記Ｎ個のフィンガを割当てる割当てメカニズムと、

前記コードチャネルの前記少なくとも一つのＮの前記サブセットに前記パイロットのそれぞれが対応するかどうかを表す値を含むリストと前記パイロットのどれが最大の測定信号品質を持っているかを識別するインデックスとをメッセージ内に与えるメッセージフォーマッティングメカニズムとを含む請求項３３記載の通信システム。

【請求項３５】　前記複数の基地局は各々、前記それぞれのパイロットと前記それぞれのコードチャネルとを選択された地理的に別れた地域に送信する複数のセクタを含む請求項２８記載の通信システム。

【請求項３６】　前記システム制御装置は、

前記信号品質基準と等しいか、またはそれを超える前記メッセージ内に示された前記パイロットの前記信号品質のどれが前記複数の基地局のどのサブセットに対応するかを決定する制御プロセッサと、

前記制御プロセッサによって決定された前記複数の基地局の前記サブセットのコードチャネル電力レベルを制御することによって、フォワードトラフィックチャネル電力割当てを制御するための、前記複数の基地局に通知される制御信号を形成する制御信号フォーマッティングメカニズムとを含む請求項２８記載の通信システム。

【請求項３７】　前記メッセージフォーマッティングメカニズムは、

前記アクティブセットにおいて前記複数の基地局を予め決められた順序で識別するハンドオフ命令メッセージを受信する受信メカニズムと、

前記順序に対応する前記複数の基地局の各々に関するそれぞれのデータフィールドを配列し、前記パイロットの前記信号品質が前記しきい値信号に等しいか、またはそれを超えるかどうかを示す前記値を前記順序に対応する前記それぞれのデータフィールド内に配置する配列メカニズムと

からなる請求項３０記載の通信システム。

【請求項３８】　フォワードトラフィックチャネル電力割当てを変更する装置であって、

複数の基地局から送信される信号のそれぞれの信号品質を測定する手段と、前記測定手段によって測定された前記信号品質に基づいて信号品質基準を発生させる手段と、各基地局が移動ユニットのアクティブセットにある場合の、前記基準以上の測定信号品質を有する前記基地局をリストアップするビットベクトルを発生させる手段と、前記ビットベクトルを送信する送信機とからなる移動ユニットと、

前記ビットベクトルにおいて識別された前記複数の基地局に基づいて前記複数の基地局の前記フォワードトラフィックチャネル電力割当てを調整する手段と、を含む装置。

【請求項３９】　前記プロセッサは、

予め決められた時間間隔に亘って最大の測定信号品質を有する前記パイロット

の少なくとも一つに基づいて前記信号品質基準としてしきい値を発生させるしきい値発生メカニズムと、

前記パイロットの前記それぞれの信号品質を前記しきい値信号と比較する比較手段とから請求項３８記載の装置。

【請求項４０】　前記測定手段が、ｎ個のフィンガを有するダイバーシティ受信機を含むことと、

前記プロセッサが、前記ダイバーシティ受信機の少なくとも一つのフィンガが基地局からのコードチャネル信号に割当てられているかどうかを決定する決定メカニズムを含むことと、

前記ビットベクトル発生手段が、前記少なくとも一つのフィンガに割当てられたそれぞれのコードチャネル信号を与える基地局をリストアップする請求項３８記載の装置。

【請求項４１】　前記信号は、複数の異なる搬送波信号からなる請求項３８記載の装置。

【請求項４２】　前記複数の異なる搬送波信号は、対応する複数の異なる構成のアンテナから送信される請求項４１記載の装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】　本発明は、セルラ通信システム、より具体的には、符号分割多元接続（ＣＤＭＡ）セルラ通信システムにおけるフォワードトラフィックチャンネル電力割当の変更方法と装置に関する。

【０００２】

【従来の技術】

ＣＤＭＡセルラ通信システムの中で、共通の周波数域帯が、一般的にモバイルから基地局のセットへの通信のために使用され、基地局からモバイルへ通信するために他の共通周波数域帯が、一般的に使用される。他の例の中で、通信を実施するために、共通の周波数域帯のセットを使用することができる。共通周波数域帯上で多重通信を送信する主利益は、セルラ電話システムの容量の増加である。米国電気通信工業会（ＴＩＡ）により規定されたＬＳ－９５規格は、セルラ電話システムを実施するために使用される高性能のＣＤＭＡの空中インターフェースの例である。

【０００３】

ＣＤＭＡセルラ通信システムの中で同じ周波数域帯上で実施される通信のセットは、受信と送信システムの双方にとって既知である疑似ランダムノイズ（ＰＮ）コードを使用して送信されたデータを変調してから復調されることで互いに分離されてから、区別される。他の通信は、特定の全ての通信の処理の間、バックグラウンドノイズとして現れる。他の通信が、バックグラウンドノイズとして現れるので、ＩＳ－９５のようなＣＤＭＡプロトコルが、より効率的に利用可能な周波数域帯を使用するために、しばしば広範な送信電力制御を使用する。送信電力制御は、通信を的確に実施するために、通信の送信電力を最小限度に抑える。送信電力制御は、他の通信により発生したバックグラウンドノイズのレベルを下げることで全ての特定の通信の処理を容易にする。

【０００４】

基地局送信からモバイルへ同じ周波数域帯上で送信させ、またモバイルから基地局に第２の周波数域帯で送信させるるもう１つの利益は、「ソフトハンドオフ

」を使用してモバイルを第１基地局のカバレージエリアから第２基地局のカバレージエリアに移転させるのに利用できることである。ソフトハンドオフは、同時にモバイルを２個あるいはそれ以上の基地局とインターフェースさせるプロセスである。ソフトハンドオフを、第２基地局とのインターフェースが確立される前に、第１基地局とのインターフェースが打ち切られる間のハードハンドオフと対比させることができる。

【０００５】

自明の理であるが、ソフトハンドオフは、少なくとも一個の接続が常に維持されているので、一般的にハードハンドオフより頑丈である。ＣＤＭＡセルラ電話システムの中のソフトハンドオフを実施するための方法とシステムは、双方とも本発明の譲受人に譲渡され、引用で本発明の中で引用で組み込まれている、「ＣＤＭＡセルラ電話システムの中のソフトハンドオフと通信を提供するための方法とシステム」と題された１９８９年１１月７日に出願された米国特許第５，１０１，５０１号と、「ＣＤＭＡセルラ通信システムの中のソフトハンドオフに支援された移動局」と題された米国特許第５，２６７，２６１号の中で開示されている。

【０００６】

前記で引用された特許の中で説明されているソフトハンドオフ手続きに従って、各基地局は、初期のシステム同期化を得てから、セルラサイトで送信された信号の強力な時間、周波数と位相追跡を提供するためにモバイルにより使用される関連するパイロットチャネルを送信する。各基地局により送信されたパイロットチャネルは、共通の拡散コード（即ち疑似ノイズシーケンス）を使用するが、異なるコード位相オフセットを使用して、移動局が、関連する基地局から送信されたパイロットチャネルを区別できるようにする。

【０００７】

ソフトハンドオフの間、２個あるいはそれ以上の基地局は、同じフォワードリンクデータをモバイルに送信する。モバイルは、基地局のセットからの信号を受信してから、信号を合成する。合成を実施するための方法と装置は、本発明の譲受人に譲渡され、引用で本明細書の中に組み込まれている「ＣＤＭＡセルラ電話

システムの中のダイバシティー受信機」と題され、１９８９年１１月７日に出願された米国特許番号５，１０９，３９０号の中に説明されており、ＣＤＭＡセルラ電話システムの中での使用のためのダイバシティー合成方法を開示している。

【０００８】

ソフトハンドオフが、より強力な接続を提供する一方で、一部の例では、ソフトハンドオフは、またＣＤＭＡセルラ電話システムの全体の容量に対して悪影響を及ぼす。これは、ソフトハンドオフの間に生成される多重フォワードリンク送信が、対応する通信を実施するのに使用される全体の送信電力を増大させるからである。増大した送信電力は、システムにより発生した全体のバックグラウンドノイズを増大させ、他方で全体のシステムの容量を減少させる。

【０００９】

ソフトハンドオフが、システムの容量を増大させるかあるいは減少させるかは、一般的にモバイルがソフトハンドオフの間に曝される環境により左右される。モバイルが、フェーディングの環境に曝されている場合は、ソフトハンドオフによりもたらされた増大したダイバーシティーは、信号が一般的に個別に減衰するので、一般的にシステムの性能にとって有利である。モバイルが、非フェーディング環境にあるときは、しかし、データソースのダイバシティーは、一般的に冗長的である。従って、非フェーディング環境に対して、信号ソースの増大したダイバシティーによりもたらされた利益は、ソフトハンドオフが原因の送信電力の全体の増大を相殺しない。

【００１０】

【発明の解決しようとする課題】

従って、本発明の意図するところは、多重搬送波環境の中あるいは通信が実施されている環境に応答する双方の中のソフトハンドオフの間のＣＤＭＡ通信システムの形態を最適化することでＣＤＭＡ通信システムの性能を改善することである。

【００１１】

従って、本発明の目的の１つは、ソフトハンドオフの間にモバイルに対するフォワードトラフィックチャネル電力の全体の量を削減するための新規の方法を提

供することである。

本発明のもう１つの目的は、前記の方法を実行するシステムを提供することである。

本発明のもう１つの目的は、モバイルが、ソフトハンドオフの間に作動する環境を決定して、この決定に対応して、ソフトハンドオフの形態を最適化することである。

本発明は、また多重搬送波フォワードリンクに応用される。

従って、本発明の目的の１つは、多重搬送波フォワードリンクでモバイルに送信されるフォワードトラフィックチャネル電力の全体の量を削減するための新規の方法を提供することである。

本発明のもう１つの目的は、前記の方法を実施するシステムを提供することである。

本発明のもう１つの目的は、モバイルが作動している、環境を決定し、この決定に対応して多重搬送波フォワードリンクの形態を最適化することである。

【００１２】

本発明は、ソフトハンドオフと多重搬送波フォワードリンクの双方を使用するシステムに応用される。

【００１３】

【課題を解決するための手段】

本発明は、モバイルが、頻繁にビットベクトルメッセージを、モバイルにより捉えられたパイロットチャネルの「アクティブセット」の中の各基地局からのパイロットの数量化され、計測された信号の品質（例えば、信号対干渉比）を示しているシステム制御装置に送信する新規性のある方法とシステムを提供する。モバイルは、パイロットの関連する信号の品質を監視することでビットベクトルメッセージを生成し、関連するパイロットチャネルの品質を標準と比較し、ビットベクトルメッセージを移動のアクティブセットの中の関連する基地局に送信してから、ビットベクトルメッセージの中の情報をシステムの制御装置に送る。これに対応して、システムの制御装置は、コマンドをモバイルのアクティブセットの中の基地局に発して、モバイルにより生成されたビットベクトルメッセージの中

で報告された関連するパイロットチャネルの品質に従って、基地局の関連するコードチャネル電力の選択された１つを調整する。

【００１４】

フォワードトラフィックチャネルが、モバイルのアクティブセットの中の基地局の関連するコードチャネルから成るので、関連するコードチャネルの送信電力の削減は、フォワードトラフィックチャネルの送信された電力を削減する。従って、ＣＤＭＡ通信システムの全体の容量は、モバイルの所での正しい受信のために必要なフォワードトラフィックチャネル電力に要する最少の放射の結果として、増大する。迅速に観察されたパイロットチャネルの品質をシステムの制御装置に通信することで、ＣＤＭＡシステムは、環境の変化に対応して迅速にシステムソースを再最適化して、通信容量を最大限度にすることができる。

【００１５】

多重搬送波リンクを使用する本発明の別の実施形態の中で、移動局は、各搬送波に対してビットを送信するか、あるいはその代わりに全てのアンテナにビットを送信する。さらに、基地局は、各搬送波上で個別に電力を調整する。

【００１６】

【発明の実施の形態】

図面に関して、参照番号は複数の図を通して同一の、または対応する部品を示し、さらに詳しく言えば、図１には、好ましいセルラ電話システムである通信システム２が示されているが、公衆回線交換（ＰＢＸ）、パーソナル通信サービス（ＰＣＳ）システム、衛星通信システム、屋内無線網または屋外無線網にも等しく適用できる。このシステム２は、システムリソース間の通信に符号分割多元接続（ＣＤＭＡ）変調および復調技術を使用する。一般に移動電話切り換えオフィス（ＭＴＳＯ）と呼ばれるシステム制御装置（セレクタ）１０には、システムが１組の基地極１２、１４、１６、１７および１９を制御できるようにするインターフェイスと処理回路がある。システム制御装置１０はまた、該当する送信先へ送信するため、公衆電話交換網（ＰＳＴＮ）から該当する基地局１２、１４、１６、１７および１９まで、電話通話のルーティングを制御する。ＰＳＴＮへの、またはＰＳＴＮからの接続は、無線、光ファイバ、または「有線」（例えば、撚

り対ケーブルや同軸ケーブル）通信のいずれであってもよい。システム制御装置１０は、データネットワーク、マルチメディアネットワーク、およびその他構内および公衆通信エンティティを含む、構内通信網および公衆通信網と通信する。さらに、システム制御装置１０は、図１に示されていない他の基地局とも通信する。

【００１７】

システム制御装置１０は、例えば専用電話回線、光ファイバリンク、同軸リンク、または無線周波数（ＲＦ）通信リンクなどの様々な手段によって、基地局１２、１４、１６、１７および１９と通信する。基地局１２、１４および１６は、例えば移動局（「モバイル」）といった他のシステムと単一搬送波無線ＣＤＭＡ通信方式によって通信する。基地局１７と１９は、矢印２６ａ■ｃによって示される３つのＣＤＭＡ信号からなる多重搬送波リンクによって、例えば移動局２１といった他のシステムと通信する。移動局２１は、単一搬送波リバースリンク２８によって、基地局１７および１９と通信する。多重搬送波フォワードリンクは４つ以上の搬送波、または２つ以下の搬送波からなることがあることに留意する。図１はまた、同一システム内に共存する多重搬送波と、より慣用されている単一搬送波のダイレクト拡散システムを示している。このような共存は可能であるが、好ましくはシステムは単一タイプのフォワードリンクを使用する、ということに留意する。

【００１８】

矢印２０ａと２０ｂはそれぞれ、基地局１２と移動局１８の間のリバースリンクとフォワードリンクを図示している。矢印２２ａと２２ｂは、基地局１４と移動局１８の間のリバースリンクとフォワードリンクを図示している。同様に、矢印２４ａと２４ｂは、基地局１６と移動局１８の間で考えられるリバースリンクとフォワードリンクを図示している。図１には、各基地局１２、１４、１６間のクロスリンク、または制御装置１０から移動局１８への直接接続や無線周波数接続は示されていないが、そのような可能性も本発明の態様に含まれる。

【００１９】

システム制御装置１０が基地局１２、１４および１６を移動局のアクティブセ

ットに割当て、各基地局に当該移動局１０とのインターフェイスを確立するよう命令すると、基地局１２、１４および１６はそれぞれ、ウォルシュコードチャネルを使ってトラフィックデータを通信フォワードリンク２０ｂ、２２ｂおよび２４ｂに載せて移動局１８へ送信する。移動局１０との通信に割当てられたコードチャネルは、トラフィックチャネルとも呼ばれる。異なる基地局から移動局へ送られた各コードチャネルには冗長（重複）情報が含まれており、移動局１０はこれを利用して、（本明細書でさらに詳しく説明する）ダイバーシティ合成メカニズムを使って各コードチャネルを組み合わせる。移動局へのフォワードリンクレートを上げるのに、同一基地局からの多重コードチャネルを使うことができる。この場合、コードチャネルの集合をトラフィックチャネルと呼ぶ。フォワードリンク信号には、トラフィックチャネルの部分集合と、例えばパイロットチャネル、同期チャネル、およびページングチャネルなどの補助制御チャネルを含むコードチャネルの集合がある。本発明は、ソフトハンドオフの間、トラフィックチャネルがアクティブになっている時間を減らすことによって、フォワードリンク信号の送信電力を減らす。

【００２０】

基地局１２、１４および１６はまた、それぞれパイロットチャネルをフォワード通信リンク２０ｂ、２２ｂおよび２４ｂを通して移動局１８へ送信する。パイロットチャネルは、同一基地局からウォルシュコードによって送信されてきたトラフィックチャネルと区別される。異なる基地局からの各パイロットチャネルは、パイロットＰＮコードシフトによって互いに区別される。ブロックやフェーディングがない場合、移動局１８が基地局１６から受信するパイロットチャネルは、移動局１８と基地局１６が最も接近した位置にあるため、基地局１２や１４の受信信号電力よりも大きな電力信号になると予想される。

【００２１】

あるいは、パイロットに対して独立したコードチャネル（ウォルシュコード）を用いる代わりに、パイロットを個々の移動局へ送られるトラフィックチャネルストリームに埋め込むか、多重化することができる。埋め込みは、特殊パイロットシンボルまたは補助信号を使うことによって行える。埋め込まれたパイロット

を使用する場合、一般的に、最初のシステム捕捉とハンドオフ時の検出に共通のパイロットが使われることになる。あるいは、別のパイロットを、各トラフィックチャネル単位で、またはトラフィックチャネルのグループ単位で送信することができる。

【００２２】

移動局１８がソフトハンドオフ領域にある場合（例えば、少なくとも１つの基地局のカバレージエリアから別の少なくとも１つの基地局のカバレージエリアへ移動する場合）、システム制御装置１０は、移動局のアクティブセットが割当てられる基地局のリストを含むハンドオフ指示メッセージを発する。ハンドオフ指示メッセージにはまた、例えばハンドオフ実施後に移動局に役立つハンドオフしきい値（例えば加算しきい値や低下しきい値）といった補助情報も含まれている。先に引用した出願およびＩＳ－９５標準規格で説明されているとおり、アクティブセットには、移動局とのインターフェイスを確立するのに使われる基地局からのパイロットが含まれる。候補セットには、移動局が最近検出した十分な長さを持つパイロットチャネル、および同じ地理領域内にあることがわかっている基地局からのパイロットチャネルが含まれる。

【００２３】

どのパイロットチャネルが妥当な強さになりやすいか分かっていれば（すなわち、どの基地局が移動局の近傍候補セットに割当てられるかを知ることにより）、基地局に対応するパイロットチャネルを求めて頻繁に移動局の近傍候補セットならびにアクティブセットをサーチするという移動局で必要な処理を減らすことができる。

【００２４】

図２は、図１に示されているとおり、移動局１８から観察できる、セル１２、１４、および１６からの相対パイロットチャネル品質を示すグラフである。図２のグラフは、基地局１２、１４および１６からの３つの例示的なパイロットチャネルの時間に対して、移動局１８での総受信電力（Ｉｏ）当たりのＰＮチップ当たりエネルギー（Ｅｃ）をプロットしている。図２に示されているとおり、基地局１６からのパイロットは、時間が経過するに従って信号品質が低下し、移動局

１８が基地局１６から遠ざかっていることを示している。逆に、基地局１２からのパイロットは時間経過と共に信号品質が向上し、移動局１８が基地局１２へ向かって移動していることを示唆している。基地局１４からのパイロットの信号品質は比較的一定したままで、移動局１８は基地局１４の周辺に沿って移動していることを示している。

【００２５】

図２で問題となるエリアは、ソフトハンドオフ領域である。ソフトハンドオフ領域では、移動局１８とシステム制御装置１０は相互に通信して、セル１２、１４および１６のパイロットチャネルの相対的品質に基づいてどの基地局が移動局のアクティブセット内にあるかを判断する。図解例では、基地局１６からのパイロットチャネルのレベルが加算しきい値を越えていたため、そのパイロットチャネルは当初移動局のアクティブセット内にある。しかし、ソフトハンドオフ領域の端では、基地局１６からのパイロットは、ある時間にわたって低下しきい値レベルを下回って低下する。

【００２６】

応答では、移動局からシステム制御装置１０への通信により、パイロット強度測定値メッセージを使って、基地局１６はシステム制御装置１０によりアクティブセットから外される。基地局１４からのパイロットは、加算しきい値レベルを決して越えないため、基地局１４は、アクティブセットに加えられない。対照的に、基地局１２は、必要な時間にわたり加算しきい値を越え、したがって移動局１８が生成するパイロット強度測定値メッセージに応答してシステム制御装置１０により判定されたときに、アクティブセットに加えられる。ソフトハンドオフ領域の端近くでは、基地局１２の信号だけが移動局１８のアクティブセット内に残る。

【００２７】

受信状態の悪いパイロットチャネルが、対応するトラフィックチャネルが移動局での受信品質にほとんど影響を与えていない場合でさえ、低下しきい値を上回り、対応する基地局をアクティブセット内に維持するのに十分な周波数であると検出されることがよくある。これはとりわけ、遅いフェーディング環境の場合に

あてはまる。遅いフェーディング環境の場合、基地局から受信した信号レベルは、相互にゆっくりと変化する。一般的に、１つの基地局は別の基地局よりしばらくは信号レベルが強く、またこの逆も成り立つ。フェーディングレートが、ダイバーシティの短期利点を得るのに十分な速さではない。従って、弱い基地局からではなく強い基地局から送信することが好ましい。

【００２８】

本発明は、関連する通信に関して生成される総送信エネルギーを減らすため、フェーディング環境でのいくつかの基地局からのコードチャネルの送信時間を短縮することを追及している。特定の通信の総送信エネルギーを低下させれば、システム全体の容量を高めることができる。それには基地局をアクティブセットから除外するハンドオフプロシージャーを用いることができ、それによって送信電力を減らせる可能性があることに留意すべきである。これは、他の基地局からの信号がより強い信号になったとき、その基地局からの送信に迅速に切りかえることを難しくする。

【００２９】

もう１つの事例は、移動局で、ある基地局からの信号が別の基地局より低い信号レベルで受信されたが、まだ低下しきい値を上回っていた場合に本発明が役立つ事例である。フェーディングがほとんどない環境では、移動局で信号がより強く受信される基地局からのみ送信することが望ましい。しかし、基地局がアクティブセットから外れ、その後その基地局をアクティブセットに戻すためハンドオフプロシージャーを用いると、このパイロットが強くなる場合にかなりの遅れをもたらす。この遅延はリンクの品質を減少させ、通話を低下させることになる。

【００３０】

図３は、移動局１８のブロック図である。アンテナ３０は、ダイプレクサを通してアナログ受信機３４および送信電力増幅器３６に合成されている。ダイプレクサ３２はアンテナ３０と協力して、アンテナ３０を通して同時送受信が行えるようにする。アンテナ３０は、各基地局１２、１４および１６からＲＦエネルギーを受信する（図１）一方、ダイプレクサ３２を通してアナログ受信機３４へルーティングされるパイロットチャネル信号とコードチャネル信号を受信する。ア

ナログ受信機３４は、ダイプレクサ３２からＲＦエネルギーを受信し、リバースリンク（すなわち移動局から基地局へ）での送信のために移動局の送信電力を調整する開ループ電力制御機能を実行する。もっと詳しく言えば、本発明の譲受人へ譲渡された、ここに参照表示することにより本明細書に編入される、「ＣＤＭＡセルラ移動電話システムでの送信電力制御の方法と装置」と題された米国特許第５，０５６，１０９号で論じられているとおり、受信機３４はアナログ電力制御信号を生成し、これが送信電力制御回路３８へ送られる。制御プロセッサ４６は、フォワードリンクで送信され、デジタルデータ受信機４０、４２、および４５によって復調されるリバースリンク電力制御ビットストリームを用いて、閉ループ電力制御調整を開始する。アナログ受信機３４は、受信したＲＦエネルギーをベースバンド信号に変換し、ベースバンド信号をデジタル化する。

【００３１】

アナログ受信機３４からのデジタル化された出力はサーチ受信機４４へ送られ、制御プロセッサ４６の制御に従い動作するデジタルデータ受信機４０、４２および４５が各基地局からのコードチャネルを受信し、それぞれの出力がダイバーシティ合成器／デコーダ４８へ送られる。ダイバーシティ合成器／デコーダ４８は、受信機４０、４２および４５からの各出力信号を、あとで詳細に論じる、選択された合成スキームに基づいて合成する。

【００３２】

図３には３つのデジタルデータ受信機４０、４２、および４５が示されているが、ダイバーシティ合成器／デコーダ４８は一般的に、いくつかの追加デジタルデータ受信機とのインターフェイスのために設けられている。好ましくは、移動局１８に含まれるデジタルデータ受信機の数は、移動局がその合成スキームで採用するコードチャネルの最大数（各コードチャネルから生成される独立したダイレクト信号とマルチパス信号を考慮）に等しいことが好ましい。これから論じるとおり、追加データ受信機を含めることにより追加ダイバーシティ利得が可能であり、本発明は、任意の数のデジタルデータ受信機（または信号マルチチャネルデジタルデータ受信機）に適用できる。

【００３３】

デジタルデータ受信機４０、４２および４５は、ダイバーシティ合成器／デコーダ４８と協同して、「レーク」受信構造を形成する。ダイバーシティ合成器／デコーダ４８は、レーク中の３本のフィンガの役割を果たす受信機４０、４２、および４５とそれぞれ協力する。さらに詳しく言えば、異なる基地局からのコードチャネルまたは共通の基地局からのマルチパス信号を受信できるよう、制御プロセッサ４６により、受信機４０、４２および４５を設定できる。これにより、３台の受信機４０、４２および４５をすべて、異なる３つの基地局からのコードチャネル、または異なる３つの信号パスを経由して到着する１つの基地局からの１つのコードチャネル（すなわち、３つのマルチパス信号）を受信するのに使うことができる。受信機４０、４２および４５を使って、異なる基地局からのマルチパスおよびコードチャネルの任意の組合せを受信できることは明らかである。例えば、いくつかの単一チャネル受信機、マルチチャネル受信機（すなわち少なくとも１つのチャネルを持っている）、およびダイバーシティ合成器の組合せに基づき、他の多数の構成でもレーク受信機構造を実施することができる。さらに、ダイバーシティ合成器の機能を、制御プロセッサ４６または受信機４０、４２および４５の１つに組み込むことができる。

【００３４】

好ましい実施形態では、ダイバーシティ合成器／デコーダ回路４８の出力はデインタリーバとデコーダに送られる。デコーダの出力は一般的に、受信データストリームをエンドユーザデータと制御データに分割する制御ユニットを通過する。エンドユーザデータは、音声コーダのようなデータデバイスへ提供される。

【００３５】

データデバイスのデータ出力、例えば音声コードは、リバースリンクを通して、移動局アクティブセット内の基地局へ送信される。ユーザデジタルベースバンド回路５０の出力は、ベースバンド信号であり、フォーマットされ、復号化され、インターリーブ化され、送信変調器５２へ送られて変調される。送信変調器５２の出力は、制御プロセッサ４６の制御の下にある送信電力制御デバイス３８を通過する。送信電力制御回路３８は、アナログ受信機３４と閉ループ電力制御ビットが提供する電力レベル信号に基づいて、移動局１８の出力電力を調整し、出

力ＲＦ信号は、この出力信号を増幅し、増幅された出力信号をダイプレクサ３２へ送る送信電力増幅器３８を通り、アンテナ３０から送信される。

【００３６】

アナログ受信機３４からのデジタル化されたＩＦ信号には、パイロットのアクティブセット内の基地局が、移動局１８に対する干渉として働く他のＣＤＭＡ信号と共に送信したコードチャネル信号とパイロットが含まれている。受信機４０、４２、および４５の機能は、適切なＰＮシーケンスとＩＦサンプルとの相関をとることである。この相関プロセスは、移動局へ送られるメッセージを符号化するのに各コードチャネルで使われるＰＮシーケンスと整合することによって、移動局に向けられる信号対干渉比を高める「処理利得」を提供する。マッチングするＰＮシーケンスを用いて符号化されていない、意図されていない信号は、相関プロセスによって「拡散」され、それによって意図されていない信号の信号対干渉比が低下する。この相関出力は、搬送波位相基準としてパイロット搬送波を使用して、コヒーレントに検出される。この検出プロセスの結果は、一連の符号化されたデータシンボルである。

【００３７】

制御プロセッサ４６の制御下にあるサーチ受信機４４は、基地局からダイレクトパスおよび反射パス（たとえばマルチパス）を介して受信したパイロットチャネルとマルチパスパイロットチャネルを走査する。スキャナ受信機４４は、受信パイロットの品質としてＥｃ／Ｉｏと示される、総受信スペクトル密度やノイズおよび信号に対するチップ当たり受信パイロットエネルギー（Ｅｃ）を使う。受信機４４は、各パイロットチャネルとそれらの強さを示す信号強度測定値信号を制御プロセッサ４６に提供する。

【００３８】

ダイバーシティ合成器／デコーダ回路４８は、整列入力される受信信号のタイミングを調整して整列させ、それらをまとめて加算する。この加算の前に、各入力に対応するパイロットチャネルの相対的信号強度に相応する重み係数を各入力信号に乗算することができる。各パイロットの信号品質は、各基地局のコードチャネルで送信された信号の品質に対応すると推定されるため、重み係数はパイロ

ット強度に基づく。重み係数を使用する場合、合成器は最も効果的な比率のダイバーシティ合成スキームを実行する。結果として得られた合成信号ストリームを次に、ダイバーシティ合成器／デコーダ回路４８に含まれているフォワードストリームエラー検出デコーダを使って復号化する。パイロットベースの重み付け方法は、アクティブセットにある基地局が移動局へコードチャネル信号をパイロット信号と等しい割合で送信するとき、よく働く。すなわち、パイロット電力に対するコードチャネル電力の比率は、アクティブセットのすべてのメンバーで同じである。この比率が同じでない場合、他の重み付け方法が好ましいかもしれない。例えば、基地局はシグナリングメッセージまたはその他の手段によって、アクティブセット内のすべての基地局はパイロットチャネル電力に対するトラフィックチャネルの比率を移動局へ送信できる。基地局ｊに対する相対的フラクションがα_jであれば、移動局は重み$\sqrt{(\alpha_j \gamma_j)}$を使ってコードチャネルを合成することができる。ここでγ_jは基地局ｊに対するのパイロットの移動局での相対受信電力である。別の方法として、移動局は、α_jまたは$\alpha_j \gamma_j$を基地局ｊからの受信信号から推定できる。

ベースバンド回路５０には、ボイスコーダ（ボコーダ）データインターフェイスとその他ベースバンド処理機能がある。さらに、ユーザデジタルベースバンド回路５０は、音声信号をデジタイザとそこに含まれているボコーダ（ボイスコーダ）へ入力する受話器などのＩ／Ｏ回路とインターフェイスする。ユーザデジタルベースバンド回路５０の出力は、送信変調器５２へ提供され、ＰＮ搬送波信号に符号化信号を変調し、ＰＮシーケンスは出ていく通話に関して割当てられたアドレス関数に対応する。このＰＮシーケンスは、制御プロセッサ４６によって、基地局（１２、１４または１６）が送信し、受信機（４０、４２または４５）が復号化する通話セットアップ情報から定められる。

送信変調器５２の出力は、送信電力制御回路３８へ送られ、そこで受信機３４から提供されるアナログ電力制御信号によって信号送信電力が制御される。さらに、基地局により電力調整コマンドの形で制御ビットが送信され、送信電力制御回路３８はそれに応答する。送信電力制御回路３８は、電力制御変調済信号を電力増幅回路３６へ送る。電力増幅回路３６は変調された信号を増幅し、ＲＦ周波

数に変換する。送信電力増幅器３６には、変調された信号の電力を最終出力レベルまで増幅する増幅器が含まれる。増幅された出力信号はその後、基地局１２、１４および１６への送信のため信号をアンテナ３０へ合成するダイプレクサ３４へ送られる。システム制御装置のための信号を、基地局１２、１４および１６が受信し、それら信号が合成されるシステム制御装置１０へそれぞれ送られる。

【００３９】

図４は、ダイバーシティ受信機が最適比率合成を実行する場合のＥｂ／Ｎｏに対するフレームエラーレートの確率として測定した、ダイバーシティ受信機性能のグラフである。フィンガが１本（Ｍ＝１）、フィンガが２本（Ｍ＝２）、フィンガが３本（Ｍ＝３）、またはフィンガが４本（Ｍ＝４）の、それぞれのフィンガ数に対応する数の基地局から信号を受信するよう構成された移動受信機について、フレームエラーレートの確率を示す４本の例示的曲線が示されている。Ｍ＝１の曲線とＭ＝２の曲線を比較すると、２本のフィンガを持ち、２本のパスを処理する受信機の性能は、１本のパスを処理する受信機の性能より優れている。この比較は、与えられたフレームエラーレート（すなわち破線）に関して、それぞれのフレームエラー確率曲線間の距離を調べることによって行われる。典型的なグラフでは、性能の改善は距離M_{1-2}によって示される。同様に、移動局がフィンガ３本のダイバーシティ受信機を使用する場合、M_{2-3}の性能改善が達成される。その場合、一般的にM_{2-3}はM_{1-2}の性能改善よりも小さい。同様にダイバーシティ受信機に４本目のフィンガを追加すると、M_{3-4}によって示されるとおりの性能改善が可能となる。M_{3-4}は、M_{2-3}およびM_{1-2}より小さいことに留意すべきである。このように、移動局がＣＤＭＡシステム内だけの移動局である場合、ますます多くの数のフィンガを持ち、そのフィンガ数に対応する数の基地局からの送信を受信するダイバーシティ受信機は、たとえＭが大きな数になって改善がほんのわずかになっても、継続的に性能改善を行う。さらに、前記性能に関する関係は、合成プロセスへのノイズだけにはどのフィンガも寄与しないと想定している。改善の絶対量は、通信条件（例えば、フェーディングの量、フェーディングの種類、ノイズの瞬間力、基地局への近接など）に依存する。

【００４０】

ソフトハンドオフ中、システム容量はフォワードリンクとリバースリンクにダイバーシティ合成プロセスを活用することによって異なって影響される。例えば、リバースリンクでは、移動局は各々パス２０ａ、２２ａ、及び２４ａ（図１）を通して基地局１２、１４及び１６へ送信する。基地局の各々は移動局１８からの送信を受けて、これをシステム制御装置（セレクタ）１０へ送り、これはダイバーシティ合成プロセスを用いて基地局１２、１４及び１６によって設けられた各々の信号を合成する。１つの移動局１８だけが送信しているために、ダイバーシティ合成を用いることによってシステム容量は悪影響を受けることはない。

【００４１】

しかし、フォワードリンクでは、移動局１８は基地局１２、１４及び１６から送信された異なった信号（全て同一の符号化された情報を持っている）を合成させる。業界では、最大比率合成、等利得合成、及び１つの信号が処理のために選択され、他の信号は破棄されるような、単純選択を含む種々の合成方法が知られている。移動局のアクティブセットに追加の、多分過度の、数の基地局を設けることは、確かにその移動局で見られる性能を向上させることにはなるが、実際にはＣＤＭＡシステムの全体的なシステム容量を低下させることがある、それは、第１の移動局へ通信している基地局からの追加の送信は第２の移動局への背景干渉として現れるからである。特定のコードチャネルの有用性は、他の基地局からのコードチャネルに対するその強度を含む種々の要素に依存する。

【００４２】

もしダイバーシティに十分な利得があるならば、ＣＤＭＡ通信システムで放射される合計電力は典型的にはより小さくなる。しかし、本発明によって認められたように、例え追加のダイバーシティを必要としなくても、放射される総電力は妥当な性能に必要とされるよりも典型的に大きい。基地局の各々からの放射される電力量の増大または減少が影響を受けるかどうかについては、基地局と移動局との間の送信路の特性に依存する。本発明の一実施形態によれば、ＣＤＭＡシステムからの総送信電力は移動局１８とシステム制御装置（セレクタ）１０との対応を増大させることによって一層最適な作用点に設定される。システムが一層高

い容量で作動できるように、必要とする情報を移動局でどのようにして収集するかについて、以下に記述する。

【００４３】

図５は各々の基地局からの３つのパイロットＡ，Ｂ，及びＣが移動局のアクティブセットに含まれている、ソフトハンドオフエリアのＥ。／Ｉ。対時間のグラフである。図５から見られるように、ソフトハンドオフエリアの間では、パイロットＡ（点線で示す）、Ｂ（破線で示す）、及びＣ（実線で示す）の各々の通信チャネルの変化は信号強度の変化を起こさせ、そしてそのため信号対雑音の比を変化させて、各々のパイロットＡ、Ｂ及びＣを変動させる。ダイバーシティ利得を向上させる大きな可能性を与えるのはこれらの変動であり、そして本発明はフォワードトラフィックチャネルの電力割当てを迅速な形で変化させることによってシステム容量を最大限にするため、どのようにしてダイバーシティ利得を向上させるかを教示するものである。

【００４４】

パイロットＡ、Ｂ及びＣの相対パイロット品質強度（パイロット品質）はフレームからフレームへと変化し、そして図５から見られるように、信号Ａ、Ｂ及びＣの何れか１つは他の信号と関連してＳＮＲが変化する。例えば、第１のフレームでは、パイロットＡは最大のＳＮＲを与えるが、パイロットＢは最小のＳＮＲを与える。しかし、フレーム２では、パイロットＢ及びＣの対応信号対雑音比は（図５に示すように）交差交差し、そしてフレーム２の端部ではパイロットＢのＳＮＲはパイロットＣのＳＮＲよりも大きい。

【００４５】

図６は図５と同様であるが、移動局１８の制御プロッセッサ４６（図３）によって計算された、レベルΔ，（交差「ｘ」線で示す）を含む、図中、Δ，は移動局のアクティブセットのパイロットＢ及びＣの最も強い信号対雑音比の下の固定レベルΔを表す。好ましくは、Δ，は、パイロットの相対信号品質を一層細かく分解するために段階的なΔが用いられるように、さまざまなΔ，（即ち、複数のΔ）を用いてもよい。制御プロセッサ４６はしきい値信号Δ，を好ましくは継続的に、計算する、勿論、代替の個別のまたは選別された設定Δ，を作り出しても

よい。

【００４６】

図６に示したように、第１フレームの間にパイロットＡだけが、しきい値信号Δ，と同等またはこれよりも上にあり、これは、本例ではパイロットＡ自体によって設定される（即ち、パイロットＡは最も強いＳＮＲを持っており、それゆえΔ，はパイロットＡによって設定されたＳＮＲより下のレベルΔｄＢに基づいている）。また、信号ＢとＣとは信号レベルΔ，と同等またはこれよりも上にはない。従って、図６はフレーム１において（第１のフレームの［時間］軸のトップ上に書かれた文字「Ａ」が示すように）パイロットＡは信号Δ，と同等またはこれよりも上にあり、そして過去のフレーム間隔に対して最大の平均ＳＮＲを持っていることを示している。フレーム２では、最強のＳＮＲは信号Ａのものであり、次いでパイロットＢであり、最も低いパイロットはＣであって、その全てはフレームの端部でΔ，よりも高い。フレーム３及び４では、パイロットＡとＢとだけがΔ，よりも上になっている。フレーム５では、パイロットＣが最も強いＳＮＲを持っており（それゆえΔ，はパイロットＣに基づいて計算される）。次いでパイロットＡが次の最強の信号であり、そしてパイロットＢのＳＮＲよりも大きく、それらの全てはΔ，よりも上である。

【００４７】

Δ，を計算し、そしてΔ，をアクティブセットの基地局からの各々の信号の各々と比較することによって、移動局は所定のフレーム内の特定の通信チャネルに関して大量の情報を効果的に収集している。各々の基地局から送信される信号を最適に検出するために移動局のダイバシテイ受信機及び合成器を設計することによって、通信チャネルのこの特徴付けを、移動局によって活用することができる。さらに、本発明の実施形態に従って、システム制御装置がアクティブセットでの基地局間でのフォワードトラフィックチャネルの電力割当てについて同等の調整を行うことができるように、アクティブセット内でパイロットの最良の信号の品質を通信することによって、ＣＤＭＡ通信システムの性能もまた最適化される。図５に示すように、各基地局からの信号の相対ＳＮＲはフレームからフレームへと急速に変化するときに、送信基地局の最適な数及び選定は一定のままでない

ことから、情報はシステム制御装置１０（図１）へ急速に通信される。

【００４８】

また、Δ，を計算するために用いられるΔ値を移動局に予め保存しておくか、または信号メッセージまたは何か他の制御方法で移動局へ送るようにすることも出来ることを承知すべきである。また、図５及び図６はＩＳ－９５標準規格に記述されているようにトラフィックチャネルにデータフレーミング、インターリービング及びエンコーデイングするために用いられるフレームに対応するフレームの意味で記述されていることを承知されたい。しかし、これは本発明では必要ではなく、また図５及び図６に示したフレームは何ら特定の処理間隔に相当するものではなく、また２０ｍｓの例示した値よりも短くも長くてもよい。さらに、上に記述した種々の送信は異なった基地局によって発生させられる。しかし、本発明はフォワードリンク信号を放射する構成要素にも適用できる。特に、本発明は同一の信号を放射する同一の基地局の異なったアンテナにも適用される。例えば、図５及び図６の信号Ａ、Ｂ及びＣは、１つの基地局に３つのアンテナがある場合のように、同一の基地局の異なったアンテナから出すこともできる。

【００４９】

また、図５及び図６に示す信号Ａ、Ｂ及びＣのセットは、基地局またはアンテナの組合せまたは一基地局のアンテナの組合せからのものとすることも出来ることを承知するべきである。例えば、信号ＡとＢとは基地局１７の２つの異なった送信アンテナからのものとし、信号Ｃは基地局１９から送信することもできる。信号Ａ、Ｂ及びＣは同一の基地局から全て送信される多重搬送波フォワードリンクであってもよく、あるいは多重搬送波フォワードリンクを放射する異なったアンテナからの信号とすることも出来る。例えば、もし基地局１７が２つのアンテナから３つの搬送波を送信したならば、信号Ａは２つの搬送波からなり、信号Ｂは１つの搬送波から成る。信号Ａは２つの異なった別の搬送波信号からなるが、しかし、この例ではこれらの搬送波は同一のレベルで送信されるならば、両方とも同一のアンテナから放射されて、本質的に同一のレベルで移動局によって受信される。また、実際のシステムでは、移動局が追跡している（図５及び図６に示す）３つ以上の多数の信号があることも明らかである。

【００５０】

システム制御装置１０（図１）にこの情報を急速に与えるために、本発明は図７Ａ～７Ｃを参照して本明細書で論じた移動局とシステム制御装置１０との間に新規な通信プロトコルを与える。図７Ａ～７Ｃは１つまたはそれ以上の基地局（１２及び１４）によって移動局１８からセレクタ１０へ送信されたリバースリンク信号を通じてシステム制御装置（セレクタ）１０へ報告されたビットベクトルメッセージの形でのシグナリングかあるいは制御メッセージングの形を示す。一層頻繁な報告、並びに一層間の空いた報告も代替手段としてあるが、ビットベクトルメッセージは好ましくはフレーム毎に送信される。

【００５１】

本発明の一実施形態では、マルチチャネルリバースリンク信号はフォワードリンクと同様の方法で一組のウォルシュコードによって定義される一組の直交するコードチャネルから成っている。このマルチチャネルリバースリンクの設定では、システム制御装置がビットベクトルメッセージに含まれる情報に作用することが出来るまでの遅延時間を最小にするために、ビットベクトルメッセージはリバースリンクの直交するコードチャネルの１つを通じて通信されることが好ましい。そのようなリバースリンク信号を用いてデータを送信するシステム及び方法は、１９９６年５月２８日提出の本発明の譲受人へ譲渡されて参考のため本明細書に含めてある、「高データ速度ＣＤＭＡ無線通信システム」と題された、同時提出の米国特許出願番号０８／６５４，４４３に記述してある。

【００５２】

発明の別の実施形態では、ＩＳ－９５標準規格システムに用いられているように、単一コードチャネルのリバースリンク信号が用いられる。ビットベクトルメッセージはデータベクトルを時間マルチプレクシングまたはビットパンクチャしてリバースリンクＰＮコードにすることにより単一コード内で好ましくは他のユーザーデータと共に送信される。

【００５３】

図７Ａは、移動局により起こされて基地局を経てシステム制御装置１０へ送信されたパイロット品質ビットベクトルメッセージのデータ構造を示す。特に、図

７Ａは長さが短く、しかも移動局のアクティブセットのパイロットのうち、一定の標準（例えば図６のΔ，しきい値信号）またはそれ以上になった信号の品質を持ったシステム制御装置１０へ報告することが出来る、１０ビットベクトルメッセージを示す。ビットベクトルメッセージは１０ビットに限定される必要はなく、短いメッセージを持つことは望ましいけれどもビットベクトル以外の他のフォーマットであっても良い。送信されたビットの数を減らすために、ビットベクトルメッセージはハンドオフ命令メッセージでシステム制御装置から移動局へ確認されたパイロットの最初の順序に基づいた各々のパイロットチャネルの配置を考えている。

【００５４】

ＣＤＭＡ　ＩＳ－９５標準規格は、アクティブセットでの６つの部材（パイロット）まで許容し、それらの全てはパイロット品質ビットベクトルメッセージに入れることが出来る。図７Ａでは、図６を参照して記述したプロセスによって判断された最良のもの（即ち、最高の信号対干渉比）を持ったパイロットが、ハンドオフ命令メッセージで最初に移動局へ報告されたその位置を特異的に確認する、３ビットデータフィールドインデックスによって確認される。インデックスは図７Ａで３ビットデータフィールドI_1、I_2、及びI_3により示される。こうして、もし最後のハンドオフ命令メッセージで移動局へ報告された第２の基地局からのパイロットチャネルが最大のＳＮＲで受信されたならば、３ビットインデックスは２（バイナリでは０１０）にセットされるか、またはもしインデックスが０から８まで動くならば、１にセットされる。

【００５５】

ビットフィールドU^1、U^2、U^3、U^4、U^5及びU^6は各々、ハンドオフ命令メッセージで最初に掲げられた各々のパイロットを言い、そして対応するパイロットチャネルがΔ，しきい値信号）より上で受信されたかどうかを示す。例えば、データフィールドU^{1-6}のビットは１（または０）にセットされて、そのビット位置に対応するパイロットチャネルはΔ，しきい値信号と等しいかまたはそれ以上で受信されていることをシステム制御装置１０に示している。特に、もしU^1が１にセットされれば、システム制御装置１０は最後のハンドオフ命令

メッセージで確認された第１のパイロットは移動局での信号対雑音比を制御プロセッサ４６によって計算されたΔ，に等しいかまたはそれより上のものを持っていることを認めることになる。U^{2-6}もまたプロセッサ４６によって、好ましくはフレーム毎の基礎でセットされて、ビットーベクトルメッセージの基地局を経てシステム制御装置へ送信される。

【００５６】

データフィールドの最後のエレメント、H^m、はハンドオフ命令メッセージのシーケンス番号である。データフィールドH^mはシステム制御装置１０に移動局が参照しているアクティブセットの確認を与えるために用いられる。H^mは長さが数ビットであるか、またはそれは単一ビットであってもよい。単一ビットの場合には、H^mはシーケンス番号の最後のビットであってよい。こうして、もし基地局が送った１００に等しく次いで１０１バイナリの数のシーケンス番号を持ったハンドオフ命令メッセージを送信したならば、移動局はもしそれがシーケンス番号１０１のハンドオフ命令メッセージを参照していたならばH^mで１を返し、またもしそれがシーケンス番号１００をもったハンドオフ命令メッセージを参照していたならばH^mで０を返すことになろう。シーケンス番号を含めることによって、基地局は３ビットデータフィールドI_1、I_2、及びI_3で、またセットU^1、U^2、U^3、U^4、U^5、及びU^6でどのパイロットを移動局が参照しているかを積極的に決定することが出来る。

【００５７】

多重搬送波フォワードリンクを含む本発明の実施形態では、ビットベクトルU^1、U^2、U^3、U^4、U^5、及びU^6はＮ×Ｍビットまで拡張することが出来、その場合、アクティブセットにはＮ個の可能な基地局があり、また基地局にはＭ個の可能なアンテナがある。あるいは、Ｍは基地局での可能な多重搬送波フォワードリンクの数に相当させることも出来る。本実施形態では、移動局はベクトルI_1、I_2、及びI_3（Ｎ×Ｍアイテムのうち最も大きいものを確認することを一層長く必要とすることがある）を持ったＮ×Ｍ多重搬送波フォワードリンクの最も強いものを報告しており、またベクトルU^iを用いてどの他の多重搬送波チャネルがΔ，より上であるかを報告する。別の実施形態では、移動局はベクト

ルＩ$_j$を用いて、最も強い搬送波よりは寧ろ、最も強い基地局を報告し、次いでベクトルＵｉを用いてどの他の多重搬送波チャネルがΔ_rより上であるかを報告する。

【００５８】

Δ_rは最も強い基地局に関してかまたは移動局のアクティブセットの全ての基地局のうちで最も強い搬送波であり得るかをさらに注意するべきである。ＩＳ－９５で共通に用いられているように、同一の搬送波からのマルチパス成分で行われているように、多重搬送波基地局の全てのフォワードリンク搬送波からパイロットＥ$_c$／Ｉ$_o$を合計することによって最強の基地局を決定することが出来ることをさらに注意するべきである。こうして、全てのフォワードリンク搬送波及び特定の搬送波の全てのマルチパス成分からＥ$_c$／Ｉ$_o$を合計することによって基地局の合計の強度が得られる。

【００５９】

ビットフィールドメッセージに応答して、システム制御装置１０は測定したパワーメッセージを受信し、そして本明細書で論じるように、フォワードトラフィックチャネルからアクティブセットの信号のうちどれを除去するか、また基地局のうちどれを送信し続けさせるかを決定する。即ち、システム制御装置１０はビットフィールドメッセージを用いてどの基地局がΔ_rしきい値信号より下で受信されている信号を送信しているかを確認する。システム制御装置１０は次に確認された基地局に、対応する移動局へ向けられたトラフィックチャネルを送信するのを停止するように指示し、そうするとその移動局はこれらの基地局によって発生させられたフォワードリンク信号の送信力を下げる。別の実施形態では、基地局は、システム制御装置の代わりに、メッセージを受信して、それがフォワードリンクを送信するべきかどうかを決定する。この方法は遅延を低下させる、但し全ての基地局（またはフォワードリンクを送信しているべき基地局）がリバースリンク送信を受信しないこともあるので、移動局がソフトハンドオフになっているときは信頼性が薄いかもしれない。

【００６０】

対応する移動局に向けられたデータの次のフレーム中、トラフィックチャネル

を送信しないことによって基地局は応答する。確認された基地局からの信号は少なくとも１つの他のフォワードリンク信号よりも著しく低いＳＮＲで移動局１８によって受信されているために、移動局のエラー率の増加は全システムの送信力の低下に比例して小さい。確認された基地局はトラフィックチャネルを送信するのを止めても、それらの基地局内の信号プロセスソースは割当てられたままになっていて、システム制御装置１０による要求があればトラフィックチャネルを送信し始める用意が出来ている。また、これらの基地局は好ましくは移動局１８から送信されたリバースリンク信号を処理し続ける。

【００６１】

通信が続くにつれて、移動局１８はアクティブセットの基地局から受信したパイロットの関係強度を監視し続ける。パイロットの状態が変化すると、例えばパイロットが$\Delta_{,}$しきい値より上の信号を受信すると、移動局１８はこの変化は正当であることを示して別のビットフィールドメッセージを発生する。移動局１８はまた、最良のＳＮＲを持ったパイロットチャネルが変化するとビットフィールドメッセージを発生する。システム制御装置１０はビットフィールドメッセージを受信して、状況が変化したアクティブセットのある基地局に、その移動局にトラフィックチャネルを送信し始めるか、またはトラフィックチャネルの送信を停止するかを、状況に応じて指示する。各基地局は、指示が送信を始めるようにであればトラフィックチャネルを経由して次のデータフレームを送信することによって、あるいは指示がトラフィックチャネルの送信を停止するようにであれば次のデータフレームを送信しないことによって、応答する。

【００６２】

発明の別の実施形態では、移動局１８はビットフィールドメッセージを定期的に、例えば各フレームにつき一回、発生させる。トラフィックチャネルを送信するための各基地局内に割当てられたソースを保つことによって、トラフィックチャネルは迅速に活性化出来、また急速に変化する状況に呼応して不活性化できる。

【００６３】

本発明のさらに別の実施形態では、システム制御装置１０は基地局へ送られた

核データフレームに利得調整フィールドを含んでいる。利得調整フィールドはフレームが基地局から送信されるべき送信電力利得を示す。システム制御装置１０が、特定の基地局からのパイロットチャネルが最強のパイロットチャネルよりも低いΔ，しきい値信号より下で受信されていることを示すベクトルを受信したときは、その加入者に向けられた次のフレームの利得調整は下げられる。一層多くのベクトルがその基地局からのパイロットチャネルが最強のパイロットより下のΔ，しきい値に留まることを示すときはその後のフレームは一層低下させることができる。

【００６４】

制御システム１０はまた、移動局が作動している環境の安定性をより良く定めるため、受信したビットベクトルの一層進歩した分析を行うことがある。特に、制御システム１０は特定のパイロットチャネルがΔ，しきい値より上または下にあるところから変化する率を監視することがある。もし変化率が所定のしきい値を越えれば、制御システム１０は、移動局が消えているかまたは不安定な環境にあるので、ソフトハンドオフの各基地局からの信号は引き続き送信させるべきであると決定する。そのような決定がなされたときは、制御システム１０は全てのアクティブセットされている基地局に、例えあるパイロットチャネルが最良の受信パイロットチャネルより低いΔ，しきい値を検出したときでも、フォワードリンクトラフィックチャネルを引き続き送信するように指示する。

【００６５】

図７（Ｂ）は移動局から基地局を経てシステム制御装置１０へ送信されたパイロット品質ビットベクトルメッセージの別のデータ構造を示す。この別の実施形態は図７Ａに定義したデータ構造と同様のものである、但しアクティブセットの６員を確認する５ビットを含むだけである。５ビットだけを用いる、何故ならば、６番目の確認（即ち、最強の信号対雑音比を与える基地局）はパイロット品質ビットベクトルメッセージ（即ち、I_{1-3}）の最初の３ビットによって確認されるからである。パイロット品質ビットベクトルメッセージの最初の３ビットの最強の信号を独特に確認することによって、最強の基地局の位置をビット確認することをしないという暗黙の理解をして、アクティブセットの他のメンバーの各

々がパイロット品質ビットベクトルメッセージのその後のビットによって逐次確認される。

【００６６】

図７Ｃは、最初の３ビットI_{1-3}を用いてアクティブセットの基地局の最強のパイロット、二番目に強い次の３ビット、J_{1-3}、及びメンバーの三番目に強い３ビット、K_{1-3}、を独特に確認する、さらに別のパイロット品質ビットベクトルメッセージのフォーマットを示す。こうして、アクティブセットのメンバーの３つの最強のパイロットの各々は独特に確認される。この実施形態の延長は、アクティブセットのメンバーから４番目、５番目、又破６番目の最強のパイロットに追加の３つのビットを加えてこれらを独特に確認するものである。また、更なる実施形態はメッセージに追加のビットを加えて単にしきい値Δ，の上または下というよりは寧ろ一層細かい定量レベルのパイロットの関係強度を示すようにするものである。さらに別の実施形態は各パイロットに全てのＥ。／Ｉ。値を含めるものである。こうして、アクティブセットの６つの可能性のあるパイロットを持ったシステムに対して、アクティブセットの各可能なパイロットにＥ。／Ｉ。が含められる。アクティブセットの最大のパイロットのＥ。／Ｉ。を送り、次に最大のパイロットに比例する関係Ｅ。／Ｉ。値を送ることも別の可能な実施形態であることが明らかである。図７Ａ～図７Ｃの実施形態の各々は好ましくはフレーム毎の基礎での関係測定電力を報告する別の方法を規定するものではあるが、別の方法を組合せることも勿論可能である。例えば、測定された電力メッセージの最初の６ビットを用いてメンバー基地局の最初の２つの最強のパイロットを確認し、次の３つのビットを用いて次の最強の３つのパイロット（即ち、５つのメンバーのセットについて）の関係位置を確認することも出来る。

【００６７】

もう１つの別のアプローチは、移動局に送信するための単独の基地局を有するものである。この場合、たった３個のビットベクトルメッセージ（即ち、I_{1-3}）を、移動局から基地局に送信する必要がある。別の配設には、一度に１個のみのアンテナを経由して送信される多重搬送波基地局を有していなければならない。この場合は、単独のビットが、どのアンテナを使用するか特定することが必

要である。言うまでもなく、ビットを、前記で説明されている方法と組み合わせて使用することができる。

【００６８】

公知のファーストあるいは遅いフェーディングチャネル上で通信されるとき、より効果的にフェーディングの悪影響を克服するために、Δ_rしきい値を決定するための別の実施形態が利用される。Δ_rが、フレーム上で最も大きいＳ／Ｎ比を有する平均パイロットを基礎としている好ましい実施形態とは対象的に、本実施形態の中では、フレーム上の最大パイロットの最小値が、しきい値ΔＲを決定するために使用される。従って、たとえ最も強いパイロットが、フェーディングを受けたとしても、しきい値Δ_rを、フレーム上で最も強いパイロットの最少に設定することで、より多くのパイロットを、Δ_rしきい値以上にすることができる。従って、より多数の基地局から信号を組み合わせ、従ってより多数の独立あるいは少なくとも半独立パスを加えることにより、より多量のダイバーシティ利得を、達成することができる。より具体的には、ファーストフェーディング環境の中では、フレーム上の最も強いパイロットに対する最低値の前記に説明された使用が、フェーディング期間が、通常フレームの長さに対して比較的短いファーストフェーディングのシナリオに対して適切に作動するはずである。

【００６９】

しかし、主に、フェーディングの期間が、インターリーブの期間より短いときに、受信過程で使用されるインターリーバが、通常の場合ほど利益をもたらさず、遅いフェーディングに対して、レーク受信機とモバイルの性能は、ファーストフェーディング環境の中でほど性能が大きくない。しかし、フェーディングの期間がインターリーバのスパンより長い場合の遅いフェーディングでは、モバイルでの容認できる通信の質を与えるために、より大きなＥｂ／Ｎｏ．が必要である。さらに、関連するパイロットの強度の平均化を実施するための１個のフレームの期間は、関連する通信チャネルが遅いフェーディングを受けているかどうかを決定するのに充分ではない。

【００７０】

従って、実施形態の中では、関連する基地局の各々は、ビットベクトルメッセ

ージの中のU_kビット（図７Ａと７Ｂ参照）の各々を統合し正規化するフィルタを実施する。U_kビットの個々がトグルする（２つの状態に切り替わる）、即ち、状態を少なくとも一回変化させる場合、このトグルは、関連する基地局と移動局が遅いフェーディングを受けているチャネルが、遅いフェーディングを受けていることを示している。従って、ＣＤＭＡシステムのシステム性能は、遅いフェーディングを受けている基地局が、フォワードトラフィックチャネル上で送信し続けている場合に、改善される。観察されるトグル作用を、また移動局が、ソフトハンドオフ領域に置かれるべきかどうかを示すためのシステム制御装置のインディケータとして使用することができる。例えば、与えられた基地局に対するパイロット強度を示すビットフィールドが、常にほぼ０であるか、あるいは常に０である場合は、関連する基地局は、パイロットが、事実最も強いパイロットより大幅に弱いことを示さなければならず、またより弱いパイロットを作りだしている基地局は、この局が、移動局の性能に対して事実上全く利益値を加えないので、アクティブセットの中に含まれてはならない。また、移動局が、効果的にトグル動作を監視して、この局が、移動局に送信している基地局を変更することを希望するときのみ、基地局にメッセージを送信することができることは言うまでもない。

【００７１】

もう１つの実施形態で、信号送信と切り替え過程をより迅速に行うことができる。この場合、移動局は、基地局が、１個あるいはそれ以上の他の基地局からの信号より強くなったり弱くなったりした場合にフェーディングの間、基地局に信号を直接送信する。基地局は、送信することなくあるいは次のフレームを送信することなく応答する。この場合、第１フレームを一方の基地局から送信させ、次に続くフレームを他方の基地局から送信させることができるので、基地局が、基地局の制御装置より迅速に応答して、切り替えを急速にすることができる。この作用は、比較的中くらいのフェーディングレートで役立つ。信号送信と切り替えが、たとえ急速でも、フレームの間で切り替えを起こさせることができる。１つの実施形態の中で、基地局は、送信のためのデータを符号化し、インターリーブし、さらに処理する。データの出力の流れを、移動局からのフィードバックに基

づいて作動化したり非作動化する。

【００７２】

パイロット品質ビットベクトルの中のどのパイロットを特定するかを決定するためのしきい値法の代案として、第２「フィンガ割当」を、本明細書の中で説明する。モバイルの中で、移動局は、全てのアクティブセットの中の基地局から受信されたパイロットＥｃ／Ｉｏの見積を行う。モバイルが、装置のダイバーシティ受信機のフィンガを有していない場合は、パイロットに対するＥｃ／Ｉｏは、０に設定される。移動局が、与えられた基地局に割当てられたダイバーシティ受信機のフィンガを有している場合は、モバイルは、前の２０ミリ秒にわたって（あるいは、より長いか短い平均化時間が使用できることが好ましい）平均Ｅｃ／Ｉｏを決定してから、数値を報告する。２０ミリ秒の期間は、ＣＤＭＡフレーム長に対応する。移動局は、最大のＥｃ／Ｉｏ値と割当てられたインデックスＡｍを有する最大のパイロットを特定する。アクティブセットの中の他の全てのパイロットに対して、移動局は、パイロットに対するＥｃ／Ｉｏ値が、最大のパイロットに対するＥｃ／Ｉｏ値のΔ_T範囲内である場合は、ビットベクトルメッセージの中の関連するビット値を、１に設定する。受信機がＮフィンガのみしか有さない場合は、Ｎが、６以下であるとして、Ｎパイロット以上が、ビットベクトルメッセージの中に報告されない。

【００７３】

フィンガを、ダイレクト信号パスとイメージパス（即ちマルチパスイメージ）の双方に割当てることができるので、フィンガ割当方法は、「多すぎる」基地局が、モバイルにより使用可能な信号を有するものとして報告を受けることを予防する。例えば、ダイバーシティ受信機が、３本のフィンガを有しており、２個の基地局のみが３個の最高の品質の信号を作りだしている場合（即ち、各基地局とイメージ信号からのダイレクトパス）、受信機が、信号を受信するための充分なフィンガを有していないので、モバイルに送信するための第３基地局を必要としない。他方、第３基地局からのパイロットが、定期的に他の３個の信号の１つを越える場合は、ダイバーシティ受信機が、第３基地局からの信号を合成すると言う多数の例があるので、モバイルは、それにもかかわらず希望するしきい値以上

であるとして、全ての３個の局に報告することがある。従って、本発明の１つの実施形態の中で、基地局に対するパイロットＳＮ比は、フィンガに基づいて基地局からの最高のＳＮ比で報告される。

【００７４】

図８は、フォワードチャネル電力割当を調整するために好ましい方法を示しているフローチャートである。プロセスは、モバイルが、モバイルのアクティブセットの範囲内の全てのパイロットのパイロット強度（信号品質）を計測するステップＳ１で開始される。プロセスは、ここでステップＳ１の中で計測されたパイロット強度に基づいて、しきい値信号Δ_Tを生成するステップＳ３に進む。ステップＳ１の中で計測されたとおりの最大のＳＮ比を有するパイロットに基づいて、信号Δ_Tが、生成される。プロセスは、ここで関連するパイロット、パイロット$_i$が、Δ_Tより大きいかそれと等しいステップＳ５に進む。比較ステップは、できれば、フレームの範囲内あるいはマルチフレームの中の他の点で取り上げられた他のサンプル抽出間隔が、この実施形態と一致しているにもかかわらず、２０ミリ秒のフレーム期間にわたって実行され、フレーム期間の終わりで終了することが好ましい。関連するパイロット$_i$が、Δ_Tより大きいかあるいはそれと等しい場合は、関連するパイロット$_i$を示しているビットベクトルメッセージの中のビット（例えば、図７Ａ－７Ｃ参照）は、しきい値Δ_Tより大きい。しかし、ステップＳ５の中で、パイロット$_i$がΔ_Tより大きくないかあるいはそれと等しいと決定された場合は、ビットベクトルメッセージの中のビットは、関連するパイロット$_i$がΔ_Tより小さいかそれと等しいことを示すように設定される（できればビットを「０」に設定されることが好ましい）。

【００７５】

パイロット品質ビットベクトルが、ステップＳ７あるいはステップＳ９の中で形成された後で、プロセスは、モバイルが、ビットベクトルメッセージを、モバイルのアクティブセットの中の基地局に送信するステップＳ１１に進む。この時、モバイルは、モバイルの早期のビットベクトルメッセージに対応して、フォワードトラフィックチャネルの中の電力を調整するシステム制御装置１０のモバイルの見越しに基づいて、モバイルが、いつフィンガを調整するかを決定するモバ

イルのためのインディケータとしてモバイルで使用されるタイミングループを設定する。タイミングループ（連続する２０ミリ秒のフレームを計算することで、モバイルにより容易に達成できる）を設定することで、モバイルは、フォワードトラフィックチャネル送信の中でいつ変化があったかを知っている。ステップＳ１１の後で、プロセスは、基地局が、パイロット品質ビットベクトルを受信してからシステム制御装置に中継するＳ１３に進む。ステップＳ１３の後で、プロセスは、システム制御装置の所にあるセレクタが、ビットベクトルメッセージ処理してから、作動中のモバイルのセット中のどの基地局モバイルのアクティブセットが、関連するコードチャネルをモバイルに送信しなければならないかを制御する関連する基地局の各々に送信される制御メッセージを生成するステップ１５に進む。モバイルのアクティブセットの中の基地局の各々から送信を制御することで、モバイルのアクティブセットの中の基地局から放射される全電力が、削減される。

【００７６】

プロセスは、タイマーが、時間しきい値に到達した後で、モバイルは、フィンガを、ステップＳ７とＳ９の中で決定されたとおりの信号Δ_rと等しいかより大きいものとして特定された基地局と対応するダイバーシティ受信機の中で調整するステップＳ１７に進む。フィンガを調整することで、モバイルは、関連するコードチャネル上で事実送信しているモバイルのアクティブセットの中のこれ等の基地局からのみの受信されたエネルギーを合成する。ステップＳ１７の後で、プロセスは、モバイルが、モバイルのアクティブセットの中の各基地局に対する関連するパイロット強度を引続き監視することを反復する。

【００７７】

移動局が、特定のビットベクトルメッセージを生成しまた各基地局のビットベクトルメッセージに対する応答が、予め設定されたアルゴリズムに基づいているので、各基地局が、フォワードリンク割当を変更する時間は、移動局により知られている。従って、移動局は、その時送信している基地局のみからの信号を正しく組み合わせることができる。特定の移動局に送信していない基地局からの信号を組み合わせることが、結果に悪影響を与える受信プロセスに導入される不必要

なノイズの原因となることがあるので、この機能が、利点である。ノイズの作用は、を結果として性能損失、より高い必要とされるＥｂ／Ｎｏと容量の損失を生み出す恐れがある。同様に、移動局が、移動局に送信されて、大きな値からで受信された信号を合成しなかった場合は、容量の損失となる恐れがある。

【００７８】

本発明の１つの実施形態の中で、移動局は、メッセージが、正しく受信され、基地局により処理されたものとして受信されたフォワードフレームを復調するための最初の試みにより各々の基地局により受信されたビットベクトルの受信に当たっての送信のためのエラーを補正する。大部分の場合、移動局は、フレームを正しく復調するが、フレームが、エラーとなっている場合、移動局は、基地局が最近のビットベクトルメッセージを送信する前に、移動局に対して送信していた基地局のセットを使用することを試みようとする可能性がある。従って、基地局が、最新のビットベクトルメッセージを受信しなかった場合、移動局が、以前に使用された基地局のセットを使用しながらフレームを再び復調しようと試みる恐れがある。この作用のために、移動局が、バッファの中の基地局の種々のセットから受信された信号を維持する必要がある。そこで、移動局は、エラーがあったときにバッファのなかのデータを使用することになる。エラー修正処理は、図８のオプションとしてのステップＳ１９とＳ２１の中に、ステップ１９への破線で示されいるとおり図示されている。

【００７９】

図９は、モバイルのアクティブセットの中の基地局のためのフォワードトラフィックチャネル電力割当を変えるための別の方法のフローチャートである。プロセスは、モバイルが、モバイルのアクティブセットの中の各々の基地局の関連するパイロット強度を計測するステップＳ３２で、開始される。次に、ステップＳ３４の中で、モバイルは、計測されたパイロット強度に基づくしきい値信号Δｉを生成する。それから、ステップＳ３６の中で、モバイルは、関連する基地局の各々に対するダイレクト（ダイレクト１）とマルチパス信号の双方を比較してから、ダイレクトあるいはマルチパス信号が、Δ_rより大きいかあるいはそれと等しいかどうかを決めるためにダイレクトあるいはマルチパスあるいは双方を比較

する。ダイレクトあるいはマルチパスイメージが、Δ，より大きいかあるいはそれと等しい場合、プロセスは、ダイバーシティ受信機が、フィンガ（複数を含む）を、ステップＳ３６の中で決定されたとおり、Δ，より大きいダイレクトあるいはマルチパス信号あるいはその双方に割当てるステップＳ３８に進む。次に、プロセスは、ステップＳ４２に進むが、ステップＳ３６の中で、関連する基地局のダイレクトあるいはマルチパス信号の何れもが、Δ，より大きくないか等しくない場合は、プロセスは、レーク受信機のフィンガと合成器回路何れも、特定の基地局に割当てられていないステップＳ４０に進む。プロセスは、そこでステップＳ４２に進む。図９の中のΔ，が、図７の中のΔと異なることに留意しなければならない。図８の中で、Δ，は、パイロットを報告するかどうかを決定するのに使用されたが、図９の中で、Δは、レーク復調器のフィンガを割当てるかどうかを決定するのに使用される。同様に、図９の中のΔ，は、一般的に図７のΔより小さい。

【００８０】

ステップＳ４２において、モバイルは、ダイレクトおよびマルチパス信号上でモバイルの所で作られたフィンガ割当を示しているビットベクトルメッセージを基地局とアクティブセットに送信する。ダイレクトあるいはマルチパス信号の何れもがΔ，より大きい場合、モバイルは、少なくともダイレクトあるいはマルチパスイメージが、Δ，より大きいかそれと等しいことを示しているビットベクトルメッセージをフォーマットする。プロセスは、それから、システム制御装置が、モバイルの所で使用されたフィンガ割当に就いて知らされ、従ってモバイルのアクティブセットの中の基地局の各々に対するどの基地局が、移動局に送信するフォワードトラフィック電力割当を調整できるようにするために、ビットベクトルメッセージをシステムの制御装置の所にあるセレクタに中継するステップＳ４４に進む。プロセスは、それからセレクタが、制御メッセージを、どの基地局が、モバイルにより設定されたフィンガ割当に対応する関連コードチャネル上で送信すべきかを示しているモバイルのアクティブセットの中の基地局に送信するステップＳ４６に進む。基地局は、移動局が、基地局がフォワードトラフィックチャネル電力のシステム制御装置の割当について通知を受けた旨の通知を受けるよ

うに、制御メッセージをモバイルに中継する。プロセスは、それから、モバイルが、システム制御装置により生成された制御メッセージに対応してダイバーシティ受信機の中のフィンガを調整するステップＳ４８に進む。

【００８１】

移動局から基地局に、あるいは基地局から移動局に送信された制御メッセージの何れかが、エラーであるかどうかに留意しなければならない。図７に関連して説明されたものと同様の技術を、使用することができる。この場合、移動局が、基地局からの制御メッセージを受信しない場合、あるいは移動局が、フレームをエラーで受信した場合、移動局は、移動局に対して送信していた以前の基地局のセットを復調することができる。

【００８２】

別のフォワードトラフィックチャネル電力割当を変更するための方法の中で、ステップＳ１からＳ１５までは、基地局が、またモバイルにまたどの基地局が、事実この局の関連するフォワードトラフィックチャンネル上で送信しているかの表示を送信することはするが、図８の好ましい方法の中で示されているものと同じである。従って、別の実施形態の中で、モバイルではなく、システム制御装置は、どの基地局が、モバイルに送信するかを制御する。

【００８３】

本発明は、文章と図５と６の中で説明されたとおり最も強度の強いパイロットに関連するしきい値Δ_Tを設定する意味で説明されてきた。多数の別の測定基準を使用することができる。特に、パイロットが、合計E_c/I_oを充分に増加させたときのみビットU^1から‘１’を設定するものをまた使用することができる。この技術は、「無線通信システムの中のソフトハンドオフを実施するための方法と装置」と題された出願番号０８／７９０，４９７号の、本発明の譲受人に譲渡され、本明細書に引用で組み込まれている並行出願米国特許の中に説明されている。

【００８４】

本発明は、基地局と移動局のセットから全体のフォワードリンクを送信する意味で説明されている。基本的なまた補助チャネルを使用する高速データリンクを

実施するためのシステムと方法は、双方が、本発明の譲受人に譲渡され、引用で本明細書の中に組み込まれている、「ソフトハンドオフの中の高速ＣＤＭＡリンクのための伝送電力削減」と言う題名の並行米国特許出願番号０８／７９８，９４９号の中と、また「ＣＤＭＡ通信システムのための高速データ速度補助チャネル」と言う題名の並行出願米国特許出願番号０８／７８４，２８１号の中で説明されている。高速データリンクシステムの中で、フォワードリンクは、基本と補助チャネルに分けられている。基本チャネルは、アクティブセットの中で基地局から連続的に送信される。補助チャネルは、基本チャネルあるいはチャネルのサブセットとして、同じ基地局から送信される。本明細書の中で説明されている本発明を、基本チャネル、補助チャネルあるいはその双方に応用できる。

【００８５】

図１０は、多重搬送波拡散スペクトルフォワードリンクと単独搬送波広域帯拡散スペクトルリンクのスペクトル図である。完全に縮尺で示されてはいないが、多重搬送波の取り組みに対して、各搬送波に対する拡散域帯幅は、１．２５ＭＨｚとして示され、単独の搬送波の広域帯の取り組みに対して、拡散域帯幅は、３．６８６４ＭＨｚである。多重搬送波への取り組みは、各搬送波を異なる形状のアンテナから送信することができ、他方、全ての３個の搬送波のフェーディングを同時に減らすように各搬送波に対して特有のフェーディングパターンを提供し、そのために通信を遮断することを含む種々の利点を有している。

【００８６】

図１１は、本発明の実施形態の１つに従って形成された多重搬送波送信システムのブロック図である。入力データは、包旋状態に符号化され、従来の畳み込みエンコーダ１００でパンチされ、符号化された記号は、記号反復器１０２により反復されて、追加の冗長性に追加される。ブロックインターリーバ１０４は、反復された符号を、２０ミリ秒の時間の間隔で交互に配列され、交互に配列された記号は、ＸＯＲゲート１０６を経由して、ユーザーのロングコードマスクに対応して長いコード発生器１０８とデシメータ１１０により生成された１０進法化されたロングコードでスクランブルされる。スクランブルされた記号は、デマックス１１２により各々関連する搬送波信号上で送信される記号の流れに分離される

。

【００８７】

各搬送波信号に対して、関連する記号の流れは、ＱＰＳＫマッパーによりＱＰＳＫにマップされる。ＱＰＳＫ記号は、各々同じウォルシュコード変調器１１６で変調され、結果として作られたウォルシュチップは、さらに同相拡散コードＰＮｉと４相拡散コードＰＮＱで、拡散装置１１８により変調される。ＰＮＩとＰＮＱは、できれば各々の搬送波に対して同じであることが好ましい。結果として生じた拡散記号は、できればそこで各々が独特の周波数に周波数を高める装置（アップコンバータ）で転換されてから、送信されることが好ましい。図１１は、各々の搬送波に対して同じウォルシュチャネルコードによる変調を示しているが、ウォルシュチャネルコードが、異なることがある。

【００８８】

図１２は、本発明の１つの実施形態に従って構成されたときの、モバイルにより使用される、多重チャンネル信号を処理するための受信システムの一部のブロック図である。周波数がダウンコンバータにより下げられた無線周波数のエネルギーは、帯域フィルタ２００で５ＭＨｚに濾過され、Ａ／Ｄ２０２により８Ｘ１．２２８８の速度でサンプル抽出される。フィルタバンク２０４の中で、２個の１．２５ＭＨｚの部分のサンプルの周波数は、さらにデジタル方式で、１．２ＭＨｚの数値制御された発振器（ＮＣＯ）によるか、オプションとして１．２５ＭＨｚＮＣＯと２．５ＭＨｚＮＣＯによりベースバンドに下げられ、３個のサンプルのセットは、低域フィルタにより、１．２５域帯に濾過される。この低域フィルタを、受信機に整合されたフィルタあるいはフィルタの部分とすることができる。結果として生じた低域フィルタにより濾過されたデータは、レーク受信機２１０に通過し、受信機は、送信された信号の種々のマルチパスの例を復調してから合成する。結果として生じた合成された軟判定データは、デインターリーバに送られて相互配列から分解されてから複号される。

【００８９】

言うまでもなく、本発明の多数の改造と変形が、前記の説明に照らして可能である。従って、別添の請求項の範囲内で、本発明が、具体的に本明細書の中で説

明されている以外でも実施可能であるものと解釈されるものとする。

【図面の簡単な説明】

本発明の完全な理解と本発明の多数の付随する利点は、別添の図面に関連して、思考するとき、下記の詳しい説明を引用することで得ることができまた良く理解することができる。

【図１】

図１は、本発明に従った、例としてのＣＤＭＡセルラ電話システムのブロック図である。

【図２】

図２は、パイロットチャネルの品質対時間のグラフと、このグラフ上のソフトハンドオフの領域である。

【図３】

図３は、モバイルのブロック図である。

【図４】

図４は、Ｎフィンガダイバシティー受信機により受信されたとおりの送信する基地局の種々の数字に対するフレームエラー率対Ｅｂ／Ｎｏの確率の例を示しているグラフである。

【図５】

図５は、例としての３個のパイロットに対するソフトハンドオフ領域の範囲内のＥ。／Ｉ。対時間を示しているグラフである。

【図６】

図６は、最高のパイロットレベル以下で形成されたしきい値信号Δ，の追加がある図７Ａの中に示されたものと同様なグラフである。

【図７Ａ】

図７Ａは、チャネルの品質を示すビットベクトルメッセージに対する第１データ構造の図である。

【図７Ｂ】

図７Ｂは、チャネルの品質を示すビットベクトルメッセージに対する第２データ構造の図である。

【図７Ｃ】

図７Ｃは、チャネルの品質を示すビットベクトルメッセージに対す第３データ構造の図である。

【図８】

図８は、余分の電力が送信されたときの、アクティブセットの中の基地局から送信されたフォワードトラフィックチャネル電力の全体量を削減するためのメッセージのシーケンスのフロー図である。

【図９】

図９は、余分の電力が送信されたときの、アクティブセットの中の基地局から送信されたフォワードトラフィックチャネル電力の全体量を削減するための別のメッセージのシーケンスのフロー図である。

【図１０】

図１０は、多重搬送波フォワードリンクの図である。

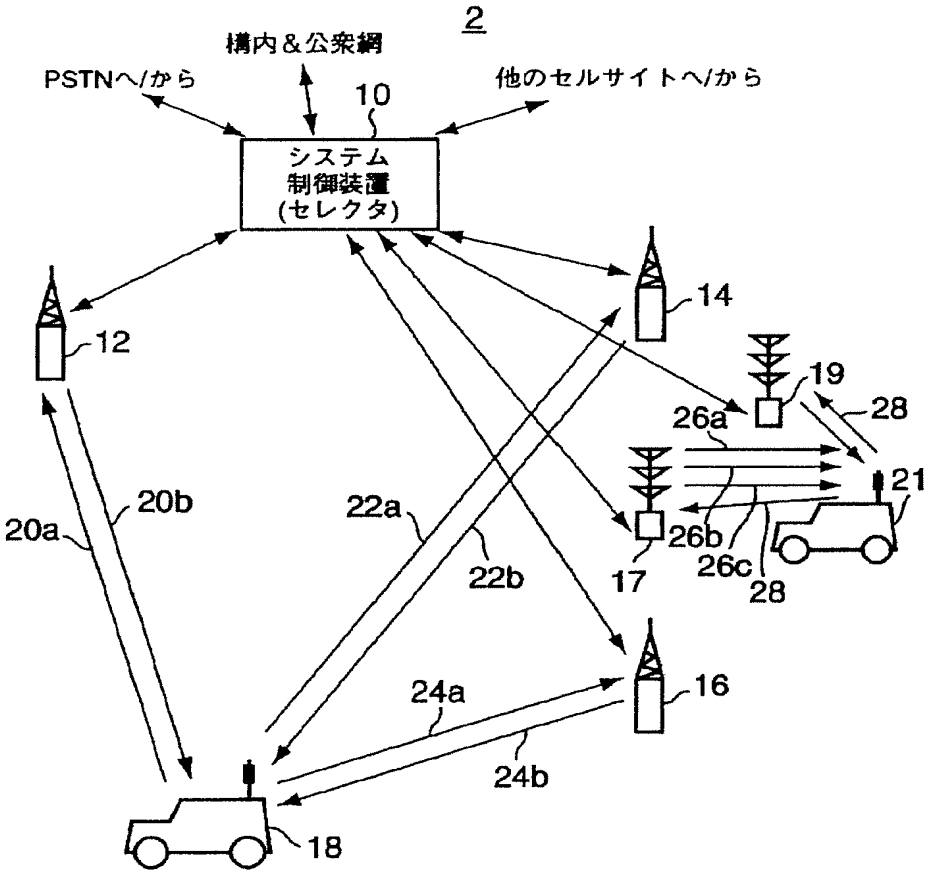
【図１１】

図１１は、多重搬送波フォワードリンクの送信機のブロック図である。

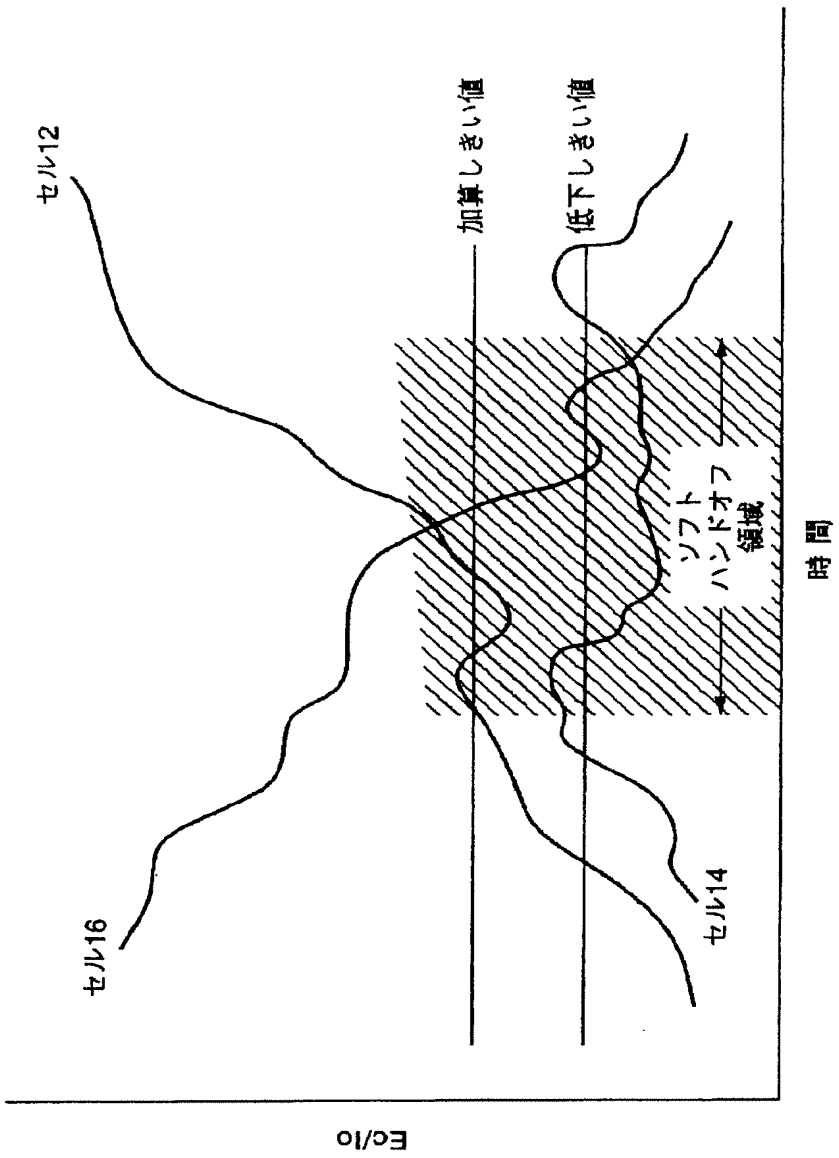
【図１２】

図１２は、多重搬送波フォワードリンク受信機のブロック図である。

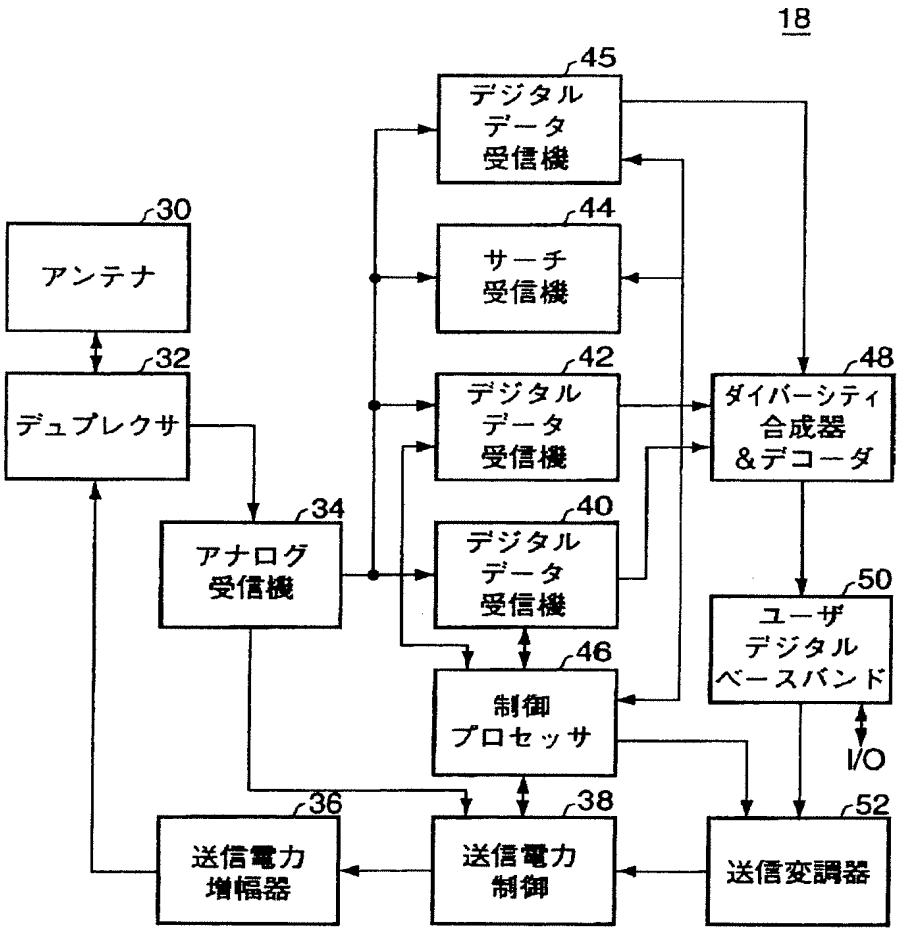
【図１】


2
構内＆公衆網
PSTNへ/から
10
他のセルサイトへ/から
システム
制御装置
(セレクタ)
12
14
19
28
26a
21
20b
20a
22a
22b
26b
26c
28
17
16
24a
24b
18

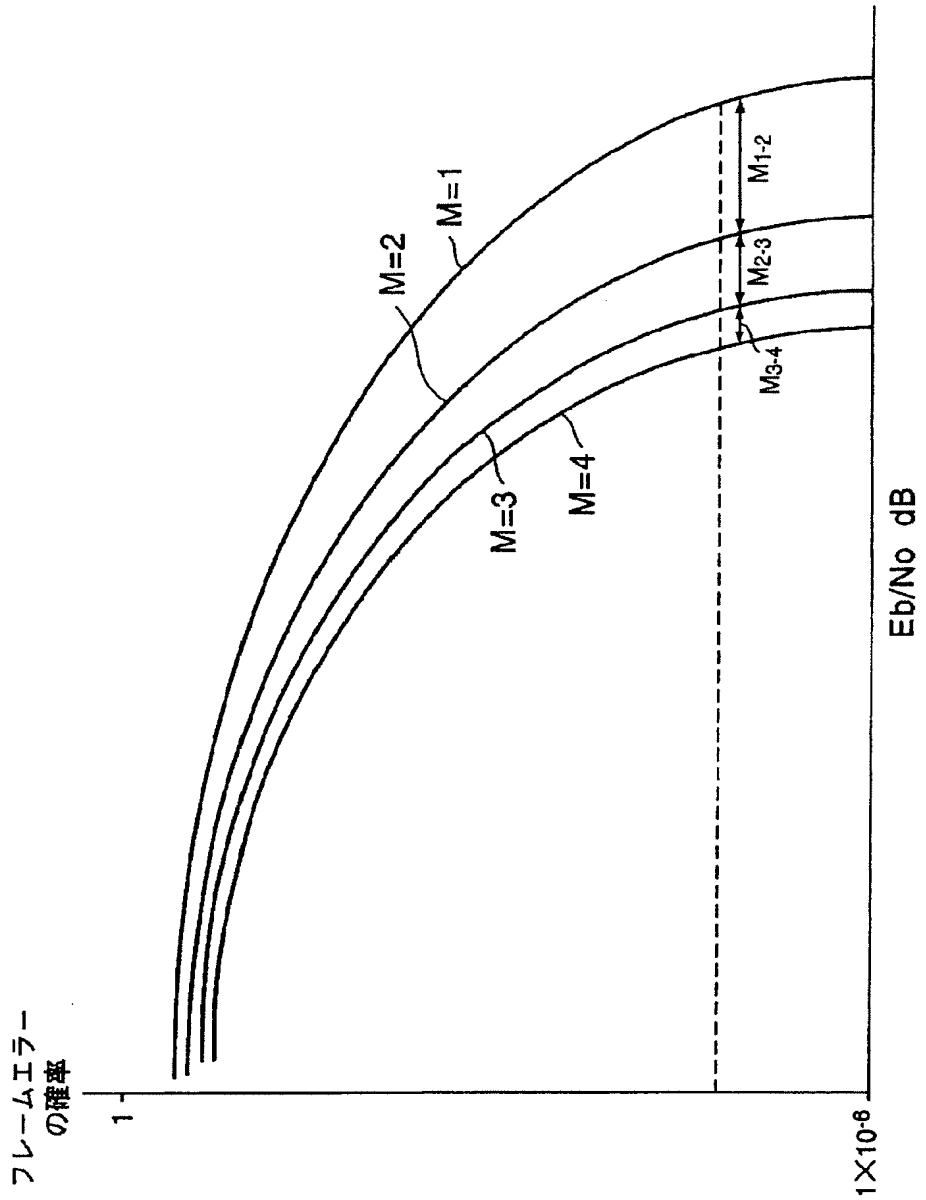
【図２】



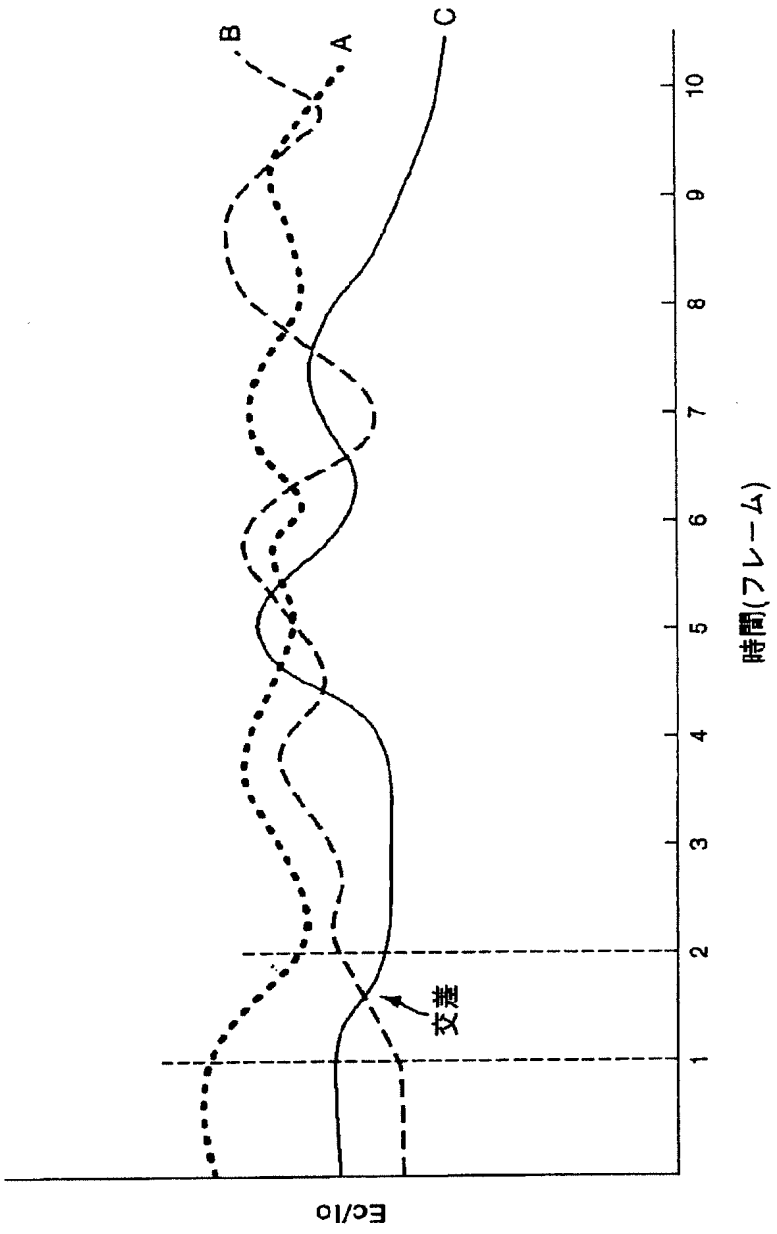
【図３】


18
45
デジタル
データ
受信機
30
アンテナ
44
サーチ
受信機
32
デュプレクサ
42
デジタル
データ
受信機
48
ダイバーシティ
合成器
&デコーダ
34
アナログ
受信機
40
デジタル
データ
受信機
50
ユーザ
デジタル
ベースバンド
46
制御
プロセッサ
I/O
36
送信電力
増幅器
38
送信電力
制御
52
送信変調器

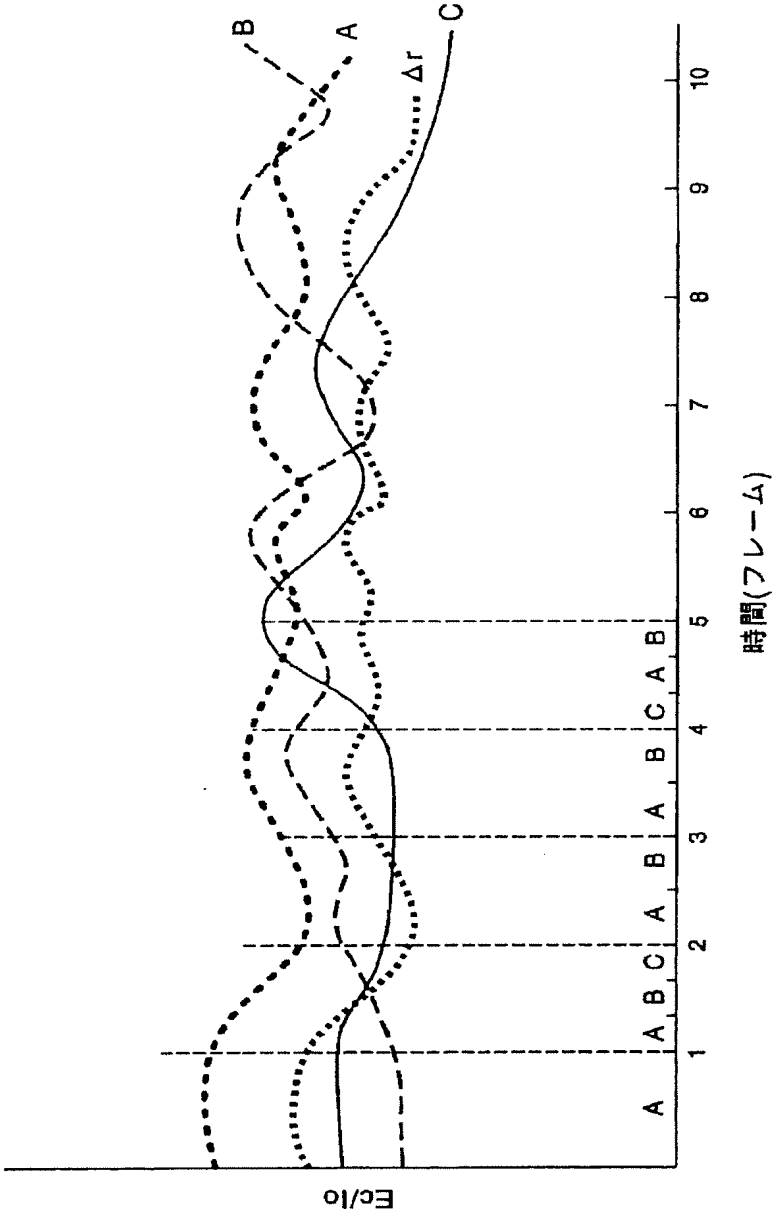
【図４】



【図５】



【図６】

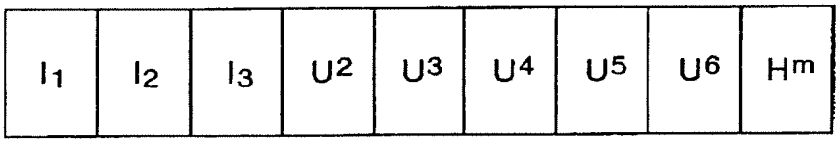


【図７Ａ】

I_1	I_2	I_3	U^1	U^2	U^3	U^4	U^5	U^6	H^m

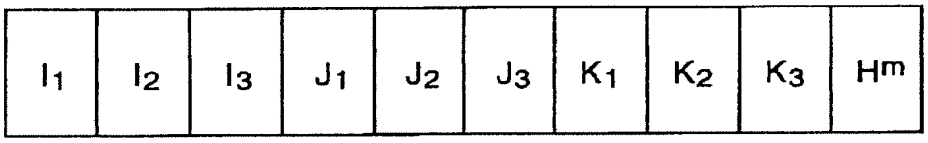
(a)

【図７Ｂ】



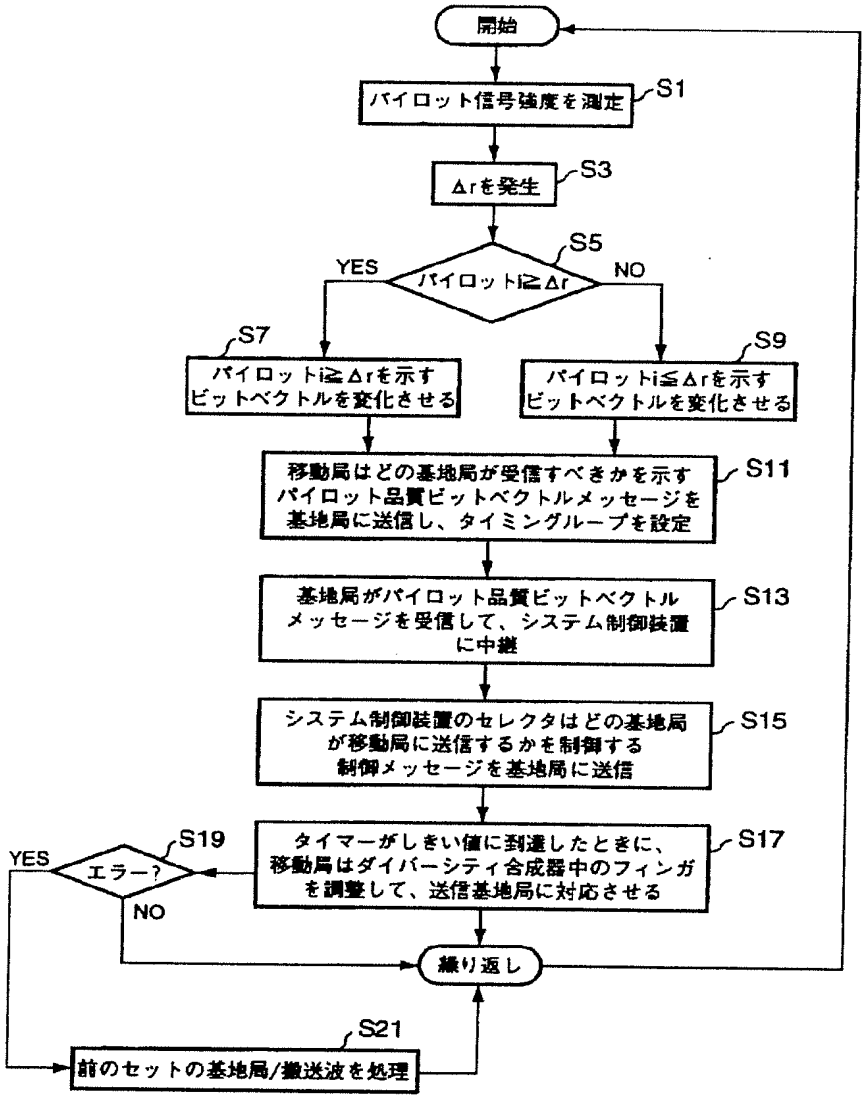
(b)

【図７Ｃ】

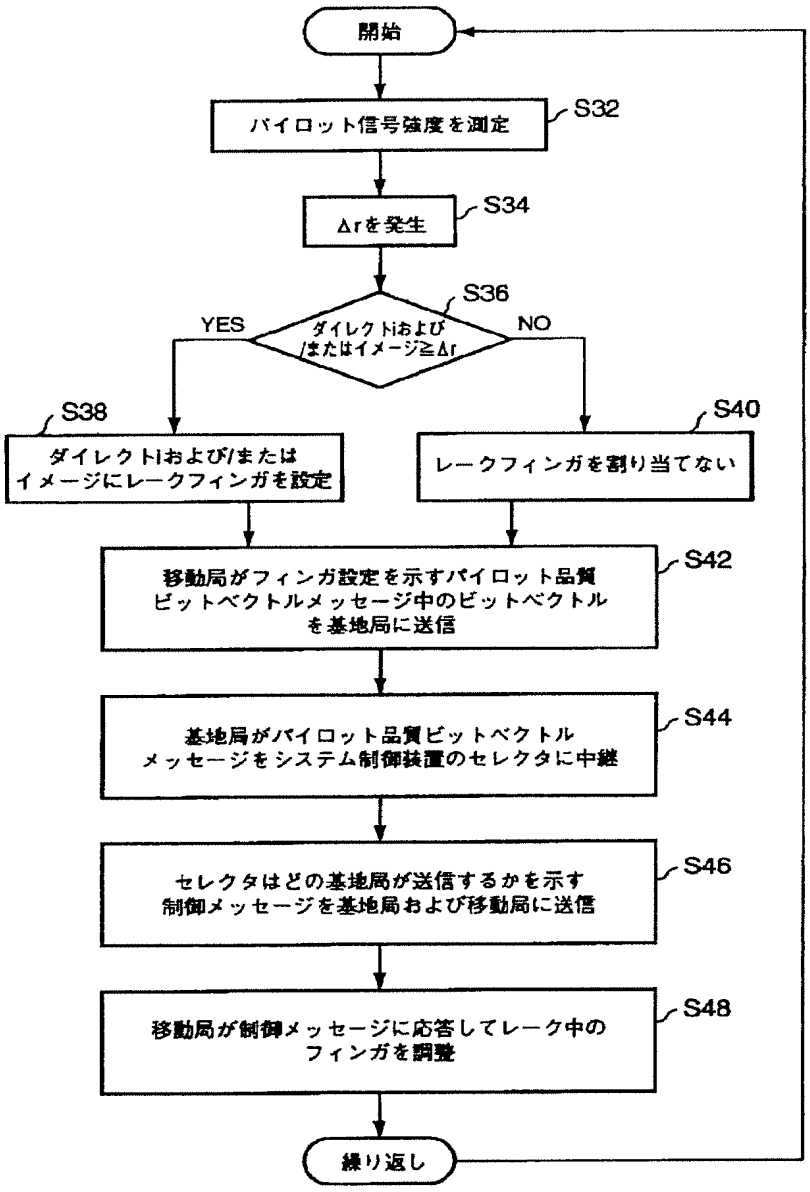


(c)

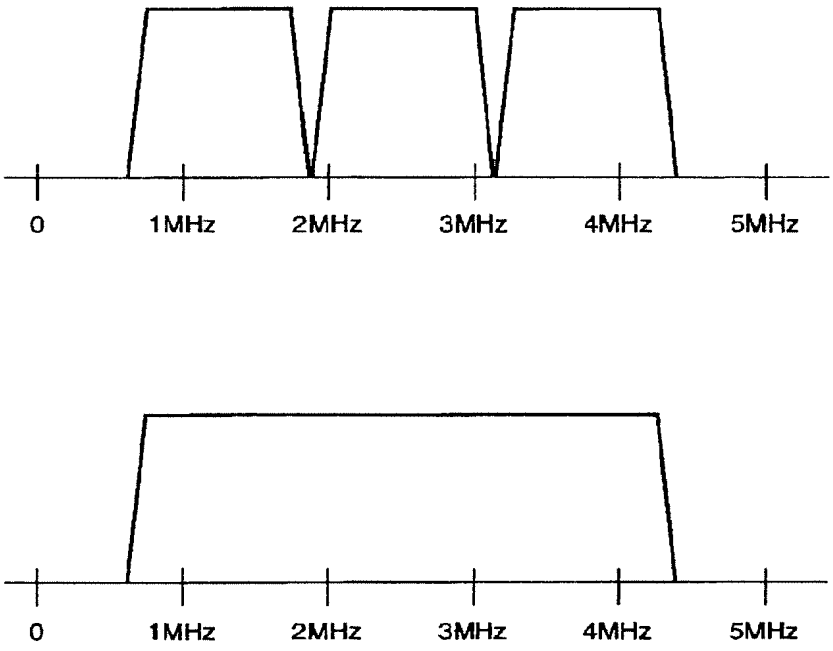
【図８】


開始
パイロット信号強度を測定
S1
Δrを発生
S3
S5
YES
パイロットI≧Δr
NO
S7
パイロットI≧Δrを示す
ビットベクトルを変化させる
S9
パイロットI≦Δrを示す
ビットベクトルを変化させる
移動局はどの基地局が受信すべきかを示す
パイロット品質ビットベクトルメッセージを
基地局に送信し、タイミングループを設定
S11
基地局がパイロット品質ビットベクトル
メッセージを受信して、システム制御装置
に中継
S13
システム制御装置のセレクタはどの基地局
が移動局に送信するかを制御する
制御メッセージを基地局に送信
S15
タイマーがしきい値に到達したときに、
移動局はダイバーシティ合成器中のフィンガ
を調整して、送信基地局に対応させる
S17
S19
YES
エラー?
NO
繰り返し
S21
前のセットの基地局/搬送波を処理

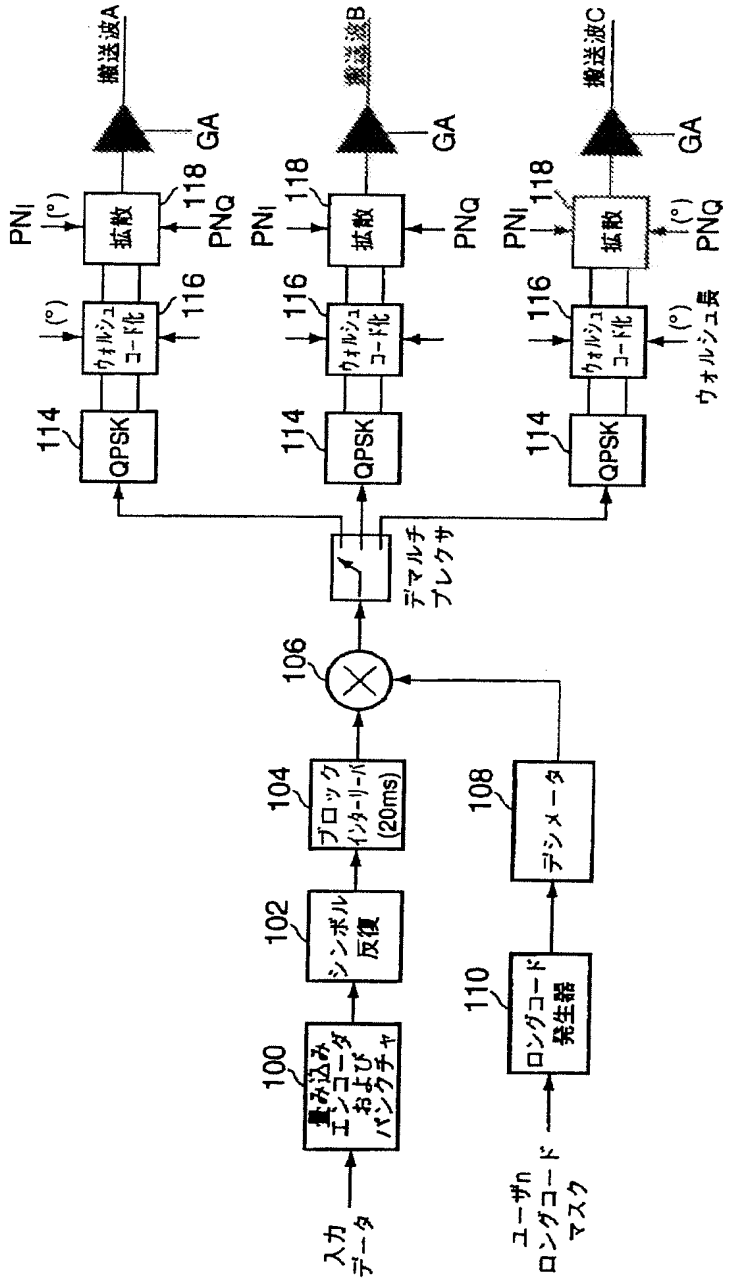
【図９】


開始
パイロット信号強度を測定
S32
Δrを発生
S34
S36
ダイレクトiおよび/またはイメージ≧Δr
YES
NO
S38
ダイレクトiおよび/またはイメージにレークフィンガを設定
S40
レークフィンガを割り当てない
移動局がフィンガ設定を示すパイロット品質ビットベクトルメッセージ中のビットベクトルを基地局に送信
S42
基地局がパイロット品質ビットベクトルメッセージをシステム制御装置のセレクタに中継
S44
セレクタはどの基地局が送信するかを示す制御メッセージを基地局および移動局に送信
S46
移動局が制御メッセージに応答してレーク中のフィンガを調整
S48
繰り返し

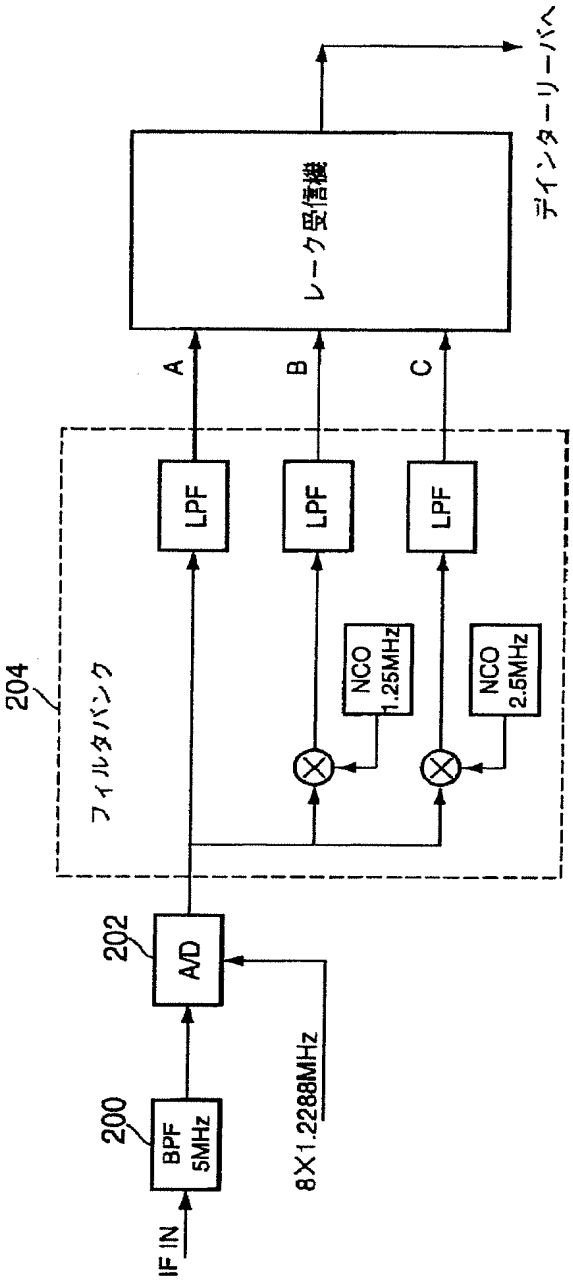
【図１０】



【図１１】


送信波A
送信波B
送信波C
GA
PNI
PNQ
(*)
拡散
118
ウォルシュコード化
116
QPSK
114
デマルチプレクサ
106
ブロックインターリーバ (20ms)
104
シンボル反復
102
畳み込みエンコーダおよびパンクチャ
100
入力データ
ロングコード発生器
110
デシメータ
108
ユーザnロングコードマスク
ウォルシュ長

【図１２】


IF IN
BPF 5MHz
200
8X1.2288MHz
A/D
202
204
フィルタバンク
LPF
LPF
LPF
NCO 1.25MHz
NCO 2.5MHz
A
B
C
レーク受信機
デインターリーバへ

【国際調査報告】

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 98/18712

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 5 771 451 A (TAKAI ET AL.) 23 June 1998 see abstract; figures 1,5,6 see column 6, line 58 - column 7, line 23	1
A	EP 0 566 551 A (TELEFONAKTIEBOLAGET L.M.ERICSSON) 20 October 1993 see claim 7	1
A	US 5 267 261 A (BLAKENEY ET AL.) 30 November 1993 cited in the application see abstract; figures 1,2,9 see column 9, line 3 - line 27 see column 28, line 3 - line 46	1,28

☐ Further documents are listed in the continuation of box C. ☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 January 1999	26/01/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Danielidis, S

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/US 98/18712

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP 9074378 A	18-03-1997
EP 566551 A	20-10-1993	AU 670440 B	18-07-1996
		AU 4283393 A	18-11-1993
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		NZ 252815 A	28-05-1996
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(81)指定国 EP(AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OA(BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG), AP(GH, GM, KE, LS, MW, SD, SZ, UG, ZW), EA(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW

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